

SOUTHERN CLIMATE IMPACTS PLANNING PROGRAM (SCIPP) REGIONAL INTEGRATED SCIENCES AND ASSESSMENTS PROGRAM

Phase I Final Report

September 1, 2008 – August 31, 2013

The original proposal (Climate Risk Mitigation Program) was submitted under a competitive RFP. After review, NOAA asked OU to revise the proposal with a new title and budget. The revision (Southern Climate Impacts Planning Program (SCIPP)) was the one ultimately funded on award NA08OAR4320886. This is the title that the annual report is submitted under. For the last two years, our annual performance report has been submitted under the title "Southern Climate Impacts Planning Program (SCIPP)" and has been accepted. Please accept the final report entitled "Southern Climate Impacts Planning Program (SCIPP) for the period 09/01/2008-08/31/2013.



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December 31, 2013



2. SCIPP Project Team

The Southern Climate Impacts Planning Program team consists of the following investigators, core office staff, research & support staff, summer interns, and graduate students from the University of Oklahoma (OU) and Louisiana State University (LSU). SCIPP's Stakeholder Services Committee (Advisory Committee) is also detailed below. Team personnel are current as of December 31, 2013.

Principal Investigators

Mark Shafer (OU) and Barry Keim (LSU)

Co-Investigators

Renee Edwards (LSU), Yang Hong (OU), Peter Lamb (OU), Mark Meo (OU), Kevin Robbins (LSU), and May Yuan (OU)

Core Office Staff

Program Managers: Margret Boone (OU) and Lynne Carter (LSU); Associate Program Manager: Rachel Riley (OU); Research Associate: Alek Krautmann (OU) and Hal Needham (LSU); Undergraduate Student Assistants: Katy Strnad (OU)

Research & Support Staff

Jared Bostic (OU), Kyle Brehe (LSU), Nathan Knight (LSU), Nick Richardson (OU), Luigi Romolo (LSU), David Sathiaraj (LSU), Ada Shih (OU)

Graduate Students

Laura Becker (LSU), Amanda Billiot (LSU), Jonathan Denham (LSU), Rebekah Jones (LSU), Carly Kovacic (OU), Carrie Pavlowsky (OU), Zhen Zhang (OU)

Stakeholder Services Committee (SCIPP Advisory Committee)

Margaret Davidson (NOAA Coastal Services Center), Jeffrey Gaffney (University of Arkansas), Gregg Garfin (University of Arizona), Marilu Hastings (Cynthia and George Mitchell Foundation), Michael Hayes (National Drought Mitigation Center), Bill Hooke (American Meteorological Society), Rebecca Jennings (Federal Emergency Management Agency), Putnam Reiter (Oklahoma Department of Emergency Management), Bob Rose (Lower Colorado River Authority), David Schlotzhauer (NWS Lower Mississippi River Forecast Center), Tracie Sempier (Mississippi-Alabama Sea Grant Consortium), Melissa Stults (University of Michigan), Russ Vose (National Climatic Data Center), Suzanne Van Cooten (NWS Lower Mississippi River Forecast Center), and Tom Wilbanks (Oak Ridge National Laboratory)

Former SCIPP Investigators

David Brown (NOAA Regional Climate Services Director, Southern Region), Ken Crawford (University of Oklahoma), Dan O'Hair (Dean, College of Communications & Information Studies, University of Kentucky)

SCIPP Student Alumni

Heather Campbell (OU), Somer Erickson (OU), Robert Gottlieb (OU), Li Liu (OU), Hal Needham (LSU), Michael Roberst (LSU), Amanda Schroeder (OU), Wanyun Shao (LSU) and Anna Trevino (LSU)

SCIPP Affiliates

Jeff Basara (OU), Jerry Brotzge (OU), Sean Crowell (OU), Scott Greene (OU), Kim Klockow (OU), Cody Knutson (OU), Heather McCarthy (OU), Renee McPherson (OU), Kodi Monroe (OU), Sea Grant)John Nielsen-Gammon (TAMU), Sascha Petersen (Adaptation International), Cindy Rosenthal (OU), and Chie Sakakibara (OU)

3. Overview

The Southern Climate Impacts Planning Program (SCIPP; <http://www.southernclimate.org>) was established in 2008 by a grant from NOAA's Regional Integrated Sciences and Assessments (RISA) Program. SCIPP's mission is to increase resiliency and preparedness for weather and climate extremes now and in the future across the South-Central United States. During its first four years, SCIPP has synthesized relevant datasets, created new assessment tools, and engaged communities in a dialogue about hazards and climate adaptation.

SCIPP was established to integrate discussions on drought with other natural hazards, such as tornadoes, hurricanes and floods, being managed by communities in Texas, Oklahoma, Louisiana, Arkansas, Mississippi and Tennessee. The initial structure was built around six elements:

1. Developing an integrated extreme events database and information system;
2. Conducting climate variability and risk assessments;
3. Creating web-based GIS services for climate risk and scenario analyses;
4. Engaging in demonstration and development projects with selected communities;
5. Providing general education and outreach; and
6. Conducting a NIDIS pilot project.

Over the years these efforts were re-aligned, based upon our interactions with stakeholders and communities, into three over-arching themes:

1. Engagement
2. Assessment
3. Tools

This new framework established more continuity between the distinct elements and more thoroughly integrated drought throughout all aspects of the project.

At the time the initial proposal was written, the project team did not anticipate such extensive involvement with the National Climate Assessment (NCA) as what occurred in subsequent years. Consequently, SCIPP became more involved in areas such as climate adaptation and our engagement with stakeholders and communities evolved from what was described in our proposal. This was done strategically and purposefully in order to capitalize on the interest of these communities and support overall RISA involvement in the NCA process. At the outset, SCIPP set down to identify communities with which we could work closely. Before these efforts came to fruition, we found that other communities, some which we had not initially targeted, came to us seeking our expertise on climate variability, change and adaptation. Consequently, our engagement took a more dynamic form than what was set forth in the original structure; however this proved beneficial to SCIPP and to the RISA program as it assured that the other efforts undertaken in this project were relevant to the needs of many communities and stakeholders throughout the region.

The following pages detail an assessment of our original goals, some of our major accomplishments, and a summary of publications, presentations and similar metrics. The categories are based off of the original timeline included in the 2008 proposal (copied here). Although activities evolved into the Engagement-Assessment-Tools framework, the original structure provided guidance and each element was addressed, as described below.

Project	Lead(s)	YEAR				
		1	2	3	4	5
Operation of Core Office -Task 1: Hire Program Manager -Task 2: Monitor and revise project schedule -Task 3: Stakeholder Services Committee meetings -Task 4: Website, Newsletter & Products -Task 5: Contacts database	Shafer	■	■	■	■	■
Element I: Integrated Extreme Events Database -Task 1: assemble information -Task 2: reconcile & review -Task 3: integrate into ACIS -Task 4: reporting capability / add events -Task 5: evaluation and revision	Robbins, Crawford	■	■	■	■	■
Element II: Climate risk assessments -Task 1: integrate existing maps -Task 2: create drought risk maps -Task 3: create severe risk maps -Task 4: create maps for 2020, 2050 & 2100 -Task 5: integrate demographic information -Task 6: evaluation and revision	Lamb, Keim	■	■	■	■	■
Element III: Climate Risk WebGIS -Task 1: Data integration & database -Task 2: spatiotemporal analysis & modeling -Task 3: assessment of community needs -Task 4: evaluation and revision	Yuan, Brown	■	■	■	■	■
Element IV: Community Engagement -Task 1: select pilot communities -Task 2: determine community metrics -Task 3: conduct community assessments -Task 4: revise information & products	Meo, Brown	■	■	■	■	■
Element V: Education & Outreach -Task 1a: develop outreach materials -Task 1b: distribute outreach materials -Task 2: conduct awareness survey -Task 3: regional workshops	O'Hair, Keim	■	■	■	■	■
Element VI: NIDIS Pilot Project -Task 1: Drought communication model – OK, MO -Task 2: Replicate model in other states -Task 3: Introduce Portal through intermediaries -Task 4: Import drought products from others	Shafer	■	■	■	■	■

4. Assessment of Original Goals

A. Program Structure

Our proposal included establishment of core offices at both the University of Oklahoma and Louisiana State University. This was accomplished with the hire of a full-time program manager in each location. Subsequently, additional personnel in both offices were added as funds became available from other sources and through unanticipated savings on the budget, such as staff at the universities not receiving raises that had been budgeted (due to the large-scale fiscal situation of the states). At the end of the first five-year period (the four years of funding described here plus one year for which we received a no-cost extension), SCIPP's core team included a Program Manager and Associate Program Manager at the University of Oklahoma and an Associate Director and Research Associate at Louisiana State University.

Coordination between the two universities was maintained through monthly video conferences, telephone and email exchanges between the co-PIs and program managers, and through in-person meetings as necessary. As planned, the core offices were able to maintain effective coordination and collaboration, develop routine and special documents (including SCIPP's monthly newsletter, *The Southern Climate Monitor*, developed and maintained the project website, engaged and tracked stakeholder communities (including maintaining a list of contacts), and responded to the needs of the overall RISA Program (including collaboration with other RISA Teams and other NOAA partners).

The proposal also called for development of an advisory committee (Stakeholder Services Committee). This committee was established in the first year of the program and met annually, each June. Meeting locations include Norman, Oklahoma; Baton Rouge, Louisiana; Austin, Texas; Biloxi, Mississippi; and Oklahoma City, Oklahoma. The Year 5 meeting was being planned for Tennessee, but logistical issues forced a change of venue. The committee consists of 15 individuals with at least one from each of the six states represented in SCIPP and several others associated with national organizations. Representation on the committee includes the National Drought Mitigation Center and another RISA Team (CLIMAS). Membership on the committee has evolved as individuals have moved positions or otherwise been unable to participate. Current membership is listed on the SCIPP website: www.southernclimate.org/team.php#ssc.

The annual advisory committee meetings included a summary of accomplishments presented by the SCIPP team and an opportunity for the members to question and comment on those accomplishments and future plans. The advisory team prepared guidance for SCIPP program management to consider over the course of the following year. The committee members were also invaluable at providing new opportunities for collaboration with other organizations and insight into regional and national trends where SCIPP's information and services could make a contribution.

Through the core office, SCIPP was able to collaborate with many researchers on proposals. This included proposals to NOAA (Sectoral Applications Research Program; RISA annual calls), NASA, National Science Foundation, and establishment of the South Central Climate Science Center through the Department of Interior (SCIPP's existing collaboration between OU and LSU became an important component of the successful proposal).

B. Element I: Integrated Extreme Events Database

Information on extreme events is spread among multiple systems and sources. This task involved identifying and integrating these diverse data sources into a unified hazards assessment database.

Task 1: Assemble Information. SCIPP identified data archives relating to severe weather events, hurricane tracks, heavy rainfall and snowfall events, extreme temperatures, and drought. It was determined that incorporating all the information into a single database was not practical. Instead, efforts focused on linking these various sources together and developing some tools to query databases (see parts C and D).

Task 2: Reconcile and Review. Because SCIPP is still developing the linkages between databases, this task was not yet developed. SCIPP did perform some internal QA on the datasets (especially storm reports) and provided that information to the National Weather Service Storm Prediction Center and NOAA National Climatic Data Center.

Task 3: Integrate into ACIS. SCIPP is developing tools to extract data records of temperatures, rainfall events, and snowfall events above or below critical thresholds from the archives in ACIS. This is being developed directly with the Southern Regional Climate Center. The query tool allows selection of user-defined thresholds and retrieves events and frequency analysis for any long-term climate observation station.

Task 4: Reporting Capability / Add Events. Because development of the GIS-based hazard assessment tool did not develop as anticipated, this reporting capability has not yet been addressed.

Task 5: Evaluation and Revision. Progress toward these goals was evaluated at each advisory committee meeting as well as forming a sub-group of developers involving members of the SCIPP team and the Southern Regional Climate Center. This part of the project morphed into the “Tools” category of the new structure and is ongoing.

C. Climate Variability and Risk Assessments

This part of the project involved placing climate events into historical perspective and linking climate change projections. SCIPP conducted extensive work to determine stakeholder’s needs – the types of information needed and the spatial and temporal scales at which it needs to be portrayed (e.g., South Central U.S. Hazard and Climate Change Planning Assessment (2009 and 2013); An Assessment of the Climate-Related Needs of Oklahoma Decision Makers; Gulf Coast Climate Information Needs Assessment; Adaptation Planning Meeting Summary Report; Blending Perspectives Report U.S. Fish and Wildlife Service; A Survey of Flood Information Needs; all available on <http://www.southernclimate.org/publications.php>). This information was utilized in the National Climate Assessment for the Great Plains and Southeast regions and Tribal, Indigenous, and Native Lands and Resources chapter. Because much work was needed to define stakeholder needs, some of these steps have not progressed as quickly and originally envisioned.

Task 1: Integrate Existing Maps. The SCIPP team identified existing hazard maps for severe storms and hurricanes. We attempted to design a single system that would unite all of this hazard information (including the data from section B above and the GIS analysis from section D below), but such a unified assessment system proved impractical. Efforts shifted to identifying quality sources of information and linking stakeholders directly to those sources. This effort is included in SCIPP’s website re-design (currently in progress).

Task 2: Develop Drought Risk Maps. The National Drought Mitigation Center is creating a similar set of maps as part of their Drought Atlas, expected to be released in early 2014. Rather than duplicating efforts, it was determined that SCIPP should link to these new resources once released.

Task 3: Develop Severe Risk Maps. Because the integrated database was not developed as originally intended, these severe risk maps were not yet able to be created. This is an ongoing area of research and development as part of the “tools” theme.

Task 4: Create Projected Risk Maps. The SCIPP Team investigated using NARRCAP downscaled projections, but establishment of the Department of Interior’s Climate Science Centers brings expertise in modeling climate. SCIPP is waiting for development of regional downscaled climate projections (a primary effort of the South Central Climate Science Center) in order to be able to develop some regional climate change risk maps. Furthermore, new research being conducted by NOAA’s National Severe Storms Laboratory is advancing our understanding of the relationship between severe storm potential and climate change. As research continues on these lines, it will better define the types of information needed from climate change models to complete this task.

Task 5: Integrate Demographic Information. Integrated demographic information was not developed because the physical datasets were not yet available. SCIPP conducted some exploratory work along these lines with a regional examination of the Social Vulnerability Index and hazard recurrence intervals (Robert Gotlieb M.S. Thesis).

Task 6: Evaluation and Revision. This is an ongoing research area as part of the tools and assessment themes.

D. Web-Based GIS for Droughts and other Climate Hazards

This part of the project would combine the extreme events data described in Part B above with the hazard risk maps and projections described in Part C in a user-selectable web-based GIS format. A prototype system for severe storm information was developed, but due to data issues and challenges of integration into ACIS, the prototype has not yet been released publicly. The prototype was tested with a focus group of stakeholders and found to supply useful information for conducting hazard risk assessments.

Task 1: Data Integration and Database Development. Spatial images and temporal plots are the primary types of information that is included in local hazard mitigation plans. The NWS Storm Prediction Center’s archive of tornadoes, hail and wind reports was successfully imported into an ARCGIS framework. The prototype GIS display provides spatial plots of tornado tracks and reported wind or hail events from the SPC database. Users can define their query by a county or city shape or by a distance from a selected point. They can also choose to display all events or limit their query by severity (for example EF2-EF5 tornadoes or hail greater than 2 inch diameter). It also graphs results from that same query showing the number of events by hour, month or year. These same techniques are currently under development for queries of temperatures, precipitation or snowfall above or below user-defined thresholds

In addition, a new database of hurricane-related storm surges, SURGEDAT (http://www.southernclimate.org/products/surge_map.php), was created. This was an entirely new database that did not exist prior to SCIPP’s involvement. The tool uses GIS to map maximum storm surges from each hurricane along the U.S. coast, and several international locations, to determine return-period frequencies. The tool has shown that surge models often underestimate return periods for significant surges.

Task 2: Spatiotemporal Analysis and Modeling. Modeling studies are dependent upon completion of the databases in Task 1. Because these are still in the prototype stage and because the National Drought

Mitigation Center's Drought Atlas is still in development, the necessary data for this part of the project are not readily available. Several exploratory studies were conducted, such as the evolution of the 2011 drought, but no conclusive studies have yet been completed.

Task 3: Assessment of Community Needs. Community needs have been identified through three approaches: focus group discussions with stakeholders, regional hazard surveys, and document analysis of state and local hazard mitigation plans (see sections 4B, 4H, 5D and 5E). These assessments indicate that the type of hazard information that SCIPP continues to develop is consistent with the needs of community hazard planners. The spatial and graphical images of the prototype GIS displays match those used in hazard plans and reported by stakeholders directly. Stakeholder interactions indicate strong interest in the severe weather hazards information, storm surge information, and extreme precipitation and temperature information.

Task 4: Evaluation and Revision. Throughout the course of the project, interactions with stakeholders have led to adjustments in the design of the prototypes, expansion of research, and integrated design of datasets. This interactive process revealed that stakeholders are comfortable using multiple datasets and that they prefer accessibility through a website rather than a stand-alone tool. This led to changes in design, particularly rather than creating a single, unified database and query/display tool to instead identifying quality information sources and tools from other agencies and organizations and linking them through a web portal. These features are being incorporated into the re-design of the SCIPP website.

E. Demonstration & Development with Selected Communities

SCIPP has worked extensively with several communities, but not in the way in which it was envisioned in the proposal. Much of the work that has developed has been in assisting coastal communities with climate adaptation planning, including locations such as Austin and Houston Texas, Biloxi Mississippi, and Mandeville Louisiana. SCIPP has been an active partner with these and other communities and through partner organizations such as NOAA Sea Grant and several Non-Governmental Organizations, providing expertise on climate history and change for direct integration into planning processes. Partly this is due to the slower than expected development of the hazards GIS tool, but it also is a function of the opportunity afforded through engagement with the National Climate Assessment. Inland areas do not feel as much pressure related to impending effects of climate change, in general, because they lack the quantifiable driver of sea-level rise. However, SCIPP continues to assist states and communities with shorter-range climate issues, such as drought response and planning through hosting or participating in forums, webinars, and planning meetings.

Task 1: Select Pilot Communities. SCIPP developed a list of communities for in-depth analysis. However, other communities self-selected and contacted SCIPP for assistance. SCIPP responded by seizing the opportunity at hand rather than pursuing other communities that may not be as engaged in climate adaptation discussions. Although most of the work has been with coastal communities, SCIPP has been engaged extensively in larger communities, such as with professional organizations managing the 2011-2013 drought and a collection of tribal nations in Oklahoma. SCIPP also collaborates closely on climate change effects on indigenous communities, hosting an inter-tribal climate change workshop in 2011 (which generated a report cited in the National Climate Assessment), developing a series of "climate 101" workshops geared for tribal needs, and collaborating with the Climate Science Center on regional workshops.

Task 2: Determine Community Metrics. Through regional meetings, workshops, surveys, and document analysis, SCIPP has identified the types of information that are important to communities. Focus group

meetings related to development of the hazards database and GIS tool clarified the types of severe weather information that communities wanted to be able to access. Most seemed interested in climate information, as they felt they already had a good handle on demographic and other variables. SCIPP also partnered with Adaptation International and CLIMAS in several proposed projects to examine critical thresholds required for community decision-making, although these have not yet come to fruition.

Task 3: Conduct Community Assessments. Formal analysis has included climate information needs assessments for Oklahoma and the Gulf Coast as part of the National Climate Assessment, regional hazard surveys of planners conducted in 2009 and repeated in 2013, and breakout sessions at an inter-tribal workshop hosted by SCIPP in 2011. SCIPP also supported a project to look at drivers of policy change in communities that had signed on to the Mayors Convention on Climate Change.

Task 4: Revise Information and Products. Our strategy for engagement has continuously evolved over the course of the project. The formal needs assessments activities generated concepts for summarized information and new datasets. The Managing Drought in the Southern Plains webinar series highlighted the need for an integrated reservoir database, on which SCIPP collaborated with the Southern Regional Climate Center to obtain funding for developing a regional database and display tools.

F. General Education / Outreach

Education and Outreach are among the strengths of SCIPP's first five years. Products produced that help SCIPP communicate with stakeholders include a dozen reports, the monthly *Southern Climate Monitor* newsletter, climate hazards brochures, and webinar summary documents, posted on <http://www.southernclimate.org/publications.php>. SCIPP's YouTube Channel <http://www.southernclimate.org/index.php/main/videos> includes archived webinars, drought briefings, and data product tutorials.

Task 1: Develop Outreach Materials. During the course of the first five years, SCIPP migrated from document production to electronic interaction, including webinars, drought briefings posted directly to YouTube, and social media (Facebook and Twitter). SCIPP maintained production of its monthly *Southern Climate Monitor* newsletter, which was begun in 2011 and produced every month since then. SCIPP also produced summary sheets on climate hazards and climate change and participated broadly in the National Climate Assessment for the Great Plains and Southeast regions. Through 2013, SCIPP conducted 21 drought webinars, 4 extreme event webinars, and 25 drought briefings.

Task 2: Conduct Awareness Survey. A survey was designed and administered in 2009 to assess the state of climate awareness, adaptation and mitigation strategies to both climate hazards and climate change, and how activities were integrated into other ongoing policies and procedures. The 2009 survey findings were summarized in *Southern U.S. Regional Hazards and Climate Change Planning Assessment* (http://www.southernclimate.org/publications/SCIPP_Hazards_Survey_Report_Final.pdf) and presented at the 2010 American Meteorological Society annual meeting. The survey was revised and distributed again in 2013 to compare changes in awareness and activities. The 2013 findings were summarized in *South Central U.S. Hazard and Climate Change Planning Assessment* (http://www.southernclimate.org/publications/Hazard_Planning_Assessment.pdf) and will be presented at the 2014 American Meteorological Society annual meeting.

Task 3: Conduct Regional Workshops. SCIPP conducted other needs assessment workshops or projects, including:

- Blending Perspectives, U.S. Fish and Wildlife Service

- Oklahoma Climate Adaptation Planning
- Oklahoma Inter-Tribal Climate Change Meeting
- An Assessment of the Climate-Related Needs of Oklahoma Decision Makers
- Gulf Coast Climate Information Needs Assessment
- A Survey of Flood Information Needs (with NWS River Forecast Centers)

In addition, SCIPP convened a workshop on communicating seasonal climate information that built off of the efforts undertaken by NOAA and partners during the 2011 Southern Plains drought and conducted a survey of stakeholders on their use of information from the drought webinars. These and other reports are included on the SCIPP publications website, <http://www.southernclimate.org/publications.php>. SCIPP Team members also participated in the National Weather Service's Weather Ready Nations meetings and in ongoing efforts related to preparedness and communication of hazards information led by a team at the National Weather Center.

G. NIDIS Pilot Project

The proposal included development of a NIDIS pilot project in Oklahoma and Missouri that would examine differences in state structures as they relate to local drought management planning and decisions. However, the exceptional drought that began in 2011 in Texas and Oklahoma provided a modification for this initial project and instead shifted the focus to the western part of the region, eventually leading to establishment of a Southern Plains Drought Regional Early Warning System. Supporting these efforts proved highly enriching in both services provided to stakeholders and to developing a regional climate services partnership, although the attention to real-time information needs delayed some of the planned efforts at building longer-term planning and capacity.

Task 1. Drought Communication Model. Heather Campbell, a SCIPP graduate student, conducted surveys in Oklahoma and Missouri to compare drought response strategies between the two states. The results were not published, but the survey template was used to create an assessment activity for each of the six states in the SCIPP region. The survey was developed in 2011 but put on hold pending the need to address shorter-term needs through the regional webinars, forums and briefings. As drought conditions have eased in much of the region, plans are to conduct these state-level surveys during 2014.

Task 2: Replicate Model in Other States. Results from the surveys, to be distributed in 2014, will form a foundation for how to approach drought planning in each state in the SCIPP region. A workshop was held in May 2011 in Memphis, Tennessee that involved representatives from water, environment, or emergency management agencies along with their respective state climatologists and a number of experts from the National Drought Mitigation Center, NIDIS, Southern Regional Climate Center and NOAA Climate Services. The meeting revealed vast differences in the nature of drought, perceptions, and needs for planning between the states. The western part of the region encounters longer-term drought that requires multi-year capacity and planning, while the eastern part of the region tends to have shorter-term droughts that still produce abundant precipitation. States in the Mississippi Delta region view the problem as typically too much water and droughts can to some extent be welcome reprieve from flooding concerns. These perspectives and planning approaches will be further investigated during Phase II of SCIPP.

Task 3: Introduce Portal Through Intermediaries. The NIDIS Drought Portal has been highlighted on each *Managing Drought in the Southern Plains* webinar and briefing, at the regional drought forums (convened by NIDIS and NOAA Climate Services with participation from SCIPP), and at the Memphis drought planning workshop. A regional survey has been designed (and will be distributed in 2014) that will

include questions on the extent to which stakeholders utilize the NIDIS portal and directly access other drought-related projects, such as the Drought Monitor and Drought Outlook.

Task 4: Import Drought Products from Others. This part of the strategy is built around release of the forthcoming Drought Atlas by the National Drought Mitigation Center. The Drought Atlas will provide historical perspective on drought at a local scale. SCIPP engagement activities, including webinars and website enhancements, will utilize this as a foundation for raising awareness of drought in the region, particularly in the wetter eastern states where drought can quickly develop substantial impacts, as evidenced in 2011 in Arkansas. SCIPP has highlighted a range of drought-related sources including products from the Climate Prediction Center, National Drought Mitigation Center, and NIDIS portal on all of its briefings and webinars.

5. SCIPP Highlights 2008-2013

The following sections highlight SCIPP activities outlined in our annual reports. For additional information, see the SCIPP annual reports on <http://www.southernclimate.org/publications.php>.

A. CPASW Workshop March 27-29, 2009

Fresh off of receiving the award notification for establishing SCIPP in 2008, SCIPP hosted the 7th annual Climate Prediction Applications Science Workshop (CPASW). Through collaboration with NOAA's National Weather Service Climate Services Division, the workshop was held on March 24-27, 2009 at the National Weather Center in Norman, OK. The workshop brought together 80 climate-focused researchers, scientists, and students to discuss the latest work in the area of climate predictions applications.

SCIPP staff took a lead role in organizing the 3.5 day workshop, including schedule development, facility arrangements, food and local transportation logistics, website development and maintenance, coordination with session moderators and presenters, and registration management.

Sessions were organized to communicate the latest in research findings as well as encourage open discussion on a number of topics. Sessions included the following: stakeholder evaluation of climate products and services, drought monitoring and tools, water issues, agricultural applications, regional climate modeling applications, extreme events and severe weather applications, international climate applications, poster session, products and tools, stakeholder perspective of climate services, fostering collaboration in decision support tool development, and adaptation.



All information pertaining to CPASW 2009, including all presentation files and recordings are available through the workshop webpage at the following address: <http://climate.ok.gov/cpasw/>.

Figure 1: Photo taken at the CPASW workshop on March 27-29, 2009 at the National Weather Center in Norman, OK.

B. SCIPP Regional Hazards and Climate Change Planning Survey

Understanding hazard planning practices and the issues that are important across the region is essential to the work of SCIPP. Knowing how needs and concerns change over time provides us with direction for how best to utilize our resources and serve our stakeholders. Below is a discussion on comparing the results of the two surveys and the implications of the results for SCIPP.

Initially administered in 2009 when SCIPP was first established (see Hocker and Carter 2010), the survey was administered again in early 2013 to determine whether changes have occurred since the first iteration. It was sent to decision makers working at governmental and non-governmental organizations at various levels throughout the SCIPP region that were thought to be involved in weather and climate hazard management, preparedness, or planning.

One goal of this study was to compare and contrast how hazard planning concerns and processes have changed over the period between 2009 and 2013. Some noteworthy findings are described below. First, the average number of staff who shared hazard planning responsibilities in a department increased slightly over the four year period from 3.13 to 3.32. About 77% of 2009 respondents cited three or fewer staff; only 71.1% of the 2013 cited three or fewer staff. Second, the ranking order of the hazard planning challenges and limitations stayed the same for the two surveys, which means that the staffing and funding limitations, in addition to other areas of their work taking precedence, remained the top 3 challenges for decision makers. In terms of the personnel involved in hazard planning, it was clear in both surveys that although emergency managers and city planners are likely to be involved, a variety of people from other agencies and organizations are involved as well. Furthermore, the decision makers continued to most commonly interact with at least the same four local, state and federal groups to carry out their hazard planning responsibilities.

Tornadoes and floods remained the top two hazards about which the respondents were concerned, although their rankings did an about-face and the respondents said it was slightly more important to plan for floods in this survey. Planning for drought rated much higher in this survey, which was probably a result of much of the SCIPP region experiencing exceptional drought over the past two to three years. When looking at the concerns by state it is interesting to note that lightning and hail were ranked in the top five in four states in 2009 but only in one state's top five in 2013 (and even then, just lightning).

The climate change section was substantially redesigned after 2009 so it is difficult to make a direct comparison between the two surveys. However, the most prominent three needs for incorporating climate change into planning activities stayed the same over the four year period. In addition, the barriers to incorporating climate change shifted, which means that some are becoming less prominent, perhaps due to the work of SCIPP and other organizations. In 2013 the top four climate change barriers were the same for the regular hazard planning barriers, which may be a product of general constraints as opposed to climate change-specific constraints.

Another goal of this study was to inform SCIPP for how to be relevant to decision makers involved in hazard planning. The ratings for how important the respondents think it is to plan for particular hazards provides direction for the hazards on which to spend our time engaging with decision makers. Furthermore, the groups with whom hazard planners most commonly interacted were the same for both iterations, which gives us direction for other agencies and organizations with which to collaborate on hazard planning initiatives.

Understanding the challenges to hazard planning such as limited staffing and funding is important because in some instances we may be able to help alleviate those challenges. We can also help fill the knowledge and expertise gap that exists among some of those involved in hazard planning. The results also highlight the need for continued improvement in engagement between decision makers and scientists, a relevant message to all climate service providers across the region. In terms of climate change, it is clear that quite a bit of uncertainty exists among decision makers on the topic. It is also clear that much more needs to be done to establish its relevance to the many decision makers whose planning horizon is typically five years or less. Therefore, continuing to provide clear and accurate information on climate change, when given the opportunity, is a good use of our time. Additionally, we can work to meet the top needs identified to encourage respondents to incorporate climate change in their planning initiatives.

C. Drought Ready Communities

Through a NOAA SARP-funded project (Drought Ready Communities) led by the National Drought Mitigation Center, SCIPP staff participated in development of materials to support drought planning, monitoring and communication in local communities. City officials from Norman, Oklahoma, have been closely involved in the project. The process and supporting materials provide a complement to the survey results of local communities to improve communication between them, state officials, and NIDIS.

The results of the Drought Ready Communities project can be found on the National Drought Mitigation Center (NDMC) website:

<http://drought.unl.edu/Planning/PlanningProcesses/DroughtReadyCommunities.aspx>

The information provided on the NDMC website includes a *Guide to Community Drought Preparedness* that helps communities throughout the United States assess and reduce their risk to drought. Efforts are continuing to collect case studies from different communities who have used the *Guide* in order to provide valuable feedback on their experiences throughout the process and to incorporate the *Guide* in drought planning promoted through SCIPP's *Managing Drought* webinar series.

D. U.S. Fish and Wildlife Service Climate Change Workshop

Through connections provided by CLIMAS (Climate Assessment for the Southwest), SCIPP developed and led a "World Cafe" break-out session at an August 2009 regional climate change workshop hosted by the U.S. Fish and Wildlife Service (Region 2) and U.S. Geological Survey. The workshop, which was attended by nearly 250 resource managers, USGS representatives, Fish and Wildlife representatives, and others, was a continuation of a similar workshop held in Tucson, AZ the prior year in which CLIMAS participated. For the 2009 workshop SCIPP team members helped to organize a series of 4 break-out sessions offered over a 2 day period. Day 1 topics focused on "Stressors" and "Needs and Priorities" while Day 2 topics focused on "Assisted Migration" and "Creating and Maintaining Connectivity on the Landscape." For each break-out session tables of 8 were formed, which consisted of a trained facilitator as well as a note-taker using a provided laptop. The facilitator helped guide the group through the questions, asked for individual responses, and kept the discussions on topic as needed. Questions for the sessions were developed by SCIPP with additional review and contribution by Fish and Wildlife partners. Data collected from the workshop were compiled into a follow-up report, with some additional support from the Fish and Wildlife Service.



Figure 2 (left). SCIPP's World Cafe exercise at the 2009 Fish and Wildlife/USGS climate change workshop.

E. SURGEDAT and Storm Surge Research

The Saffir-Simpson Hurricane Scale measures hurricane wind strength. However, it reveals very little about storm surge, which can be equally if not more devastating. SCIPP researchers Hal Needham and Barry Keim have created SURGEDAT (<http://surge.srcc.lsu.edu>), the world's most comprehensive archive of storm surge data, to provide more context on storm surges. Utilizing 67 sources of data including federal government sources, books, academic journals and more than 3,000 pages from historical newspapers, SURGEDAT initially identified over 200 surges along the U.S. Gulf Coast since 1880. The project has now expanded, incorporating hundreds of sources from all over the world to generate a global dataset and map. The database is not just a useful tool for researchers. Decision makers have also seen many benefits from SURGEDAT. Keim and Needham have been in contact with decision makers along the Gulf Coast including the Houston/Galveston National Weather Service office, the Rice University Houston Ship Channel Project, and the Texas A&M Galveston Ike Dike Project. The latter two of these groups are working on multi-million to multi-billion dollar projects for surge protection, and Keim and Needham are providing valuable climatological perspectives in each of these cases.

By March 2013, the scope of this dataset was greatly expanded. Most noticeably, ALL high water marks for each storm were identified, not just the peak height. Data available for the east coast was also expanded. These changes enlarged the dataset from around 200 high-water marks to around 7,000 high-water marks. Scripts were also written to create high water profiles of storm surge events. Enough data is available now to create more than 150 of these high-water profiles. This work has generated a lot of interest from various research groups wanting to collaborate. A web-based tool that estimates the 100-year, 50-year, etc. storm surge level for specific locations along the U.S. Gulf and Atlantic Coasts is currently in development.

Surge heights from the database were compared to pre-landfall Hurricane wind speeds. Wind speeds at 3-hour intervals were used from landfall to 36 hours before landfall for 126 separate hurricanes from 1880 through 2009. One of the major results of this research was that pre-landfall hurricane winds, particularly winds 18 hours before landfall, correlate best with storm surge heights. Another interesting result is that the relationship between hurricane winds and storm surge is non-linear, meaning a moderate increase in hurricane winds can produce a large difference in surge heights.

As part of the storm surge research project, a storm surge internet blog was also maintained. The purpose of the blog was to provide historical context for active hurricane/storm surge events. To date, the blog has received 1,290 hits from 36 different countries. Visitors from Louisiana (739 hits), and Texas (85 hits) represent two of the six top locations that viewed the blog. The dataset and blog drew international attention from India during Cyclone Phallin and the Philippines during Typhoon Haiyan. The SURGEDAT

dataset and “Hurricane Hal’s Storm Surge Blog” can be located at <http://surge.srcc.lsu.edu>. Amongst the research and collaboration efforts generated by the creation of SURGEDAT, this continually expanding dataset, along with researchers Keim and Needham, have gained generous positive publicity.

F. Water Reservoir Data and Visualization Tool

During the Southern Plains drought of 2011, SCIPP identified that water resources information was sparse, distributed and inconsistent. These facts were highlighted in several drought forums and on a webinar series, *Managing Drought in the Southern Plains*. Based upon this finding, SCIPP has pursued a two-pronged approach to addressing this problem. The Southern Regional Climate Center (SRCC) has sought and obtained funding to develop an integrated reservoir database, built upon the Applied Climate Information System (ACIS) framework. The second component is engagement of stakeholders in the region to assess requirements for design of the database and visualization tools.

SCIPP researchers met with the Oklahoma Water Quantity Forum to discuss the development of the Water Reservoir Data Visualization Tool, and to solicit input on which water reservoir variables would be most important to display. A list of roughly 10-15 variables were collected, and contained such items as conservation pool (%), total storage, inflow/outflow, and sedimentation. Likewise, collaborative work is ongoing with the Texas Water Development Board in Austin, Texas. This group has produced web-tools to depict reservoir levels in the state of Texas. SCIPP researcher Hal Needham met with them in February, 2013, to discuss collaboration on this project. They were very interested, and provided access to computer scripts that they used for their database. This will make it much easier for SCIPP to develop similar products for Texas, Oklahoma, and Louisiana. The objectives of the project include:

Objective #1: Determine stakeholder requirements for design of an integrated water reservoir database.

6. Assess desired characteristics of variables that should be included and their relative priorities;
7. Conduct similar assessments across a range of sectors, including water resources managers, recreation and tourism, energy production, fish and wildlife, and agriculture.

Objective #2: Integrate the identified requirements into an operational system.

- Work in tandem with the technical design process to identify key variables and products;
- Test prototype products with focus groups.

Objective #3: Promote use of a new system among sectors most directly impacted by water restrictions.

- Disseminate information through the *Managing Drought in the Southern Plains* webinar series;
- Present information about the system at professional association meetings, such as annual state water conferences;
- Include information in regular publications geared for a wide audience, such as the *Southern Climate Monitor* (SCIPP monthly newsletter).

G. Influential Factors on Hurricane Evacuation Decisions

Researchers at Louisiana State University (LSU) conducted more than 500 phone interviews with residents of nine Louisiana parishes to examine the roles of emotion, knowledge and past experience in preparing, evacuating and relocating as a result of hurricanes. These are decisions and strategies for coping with hurricanes, which are referred to as “hazard adjustments.” Authors Edwards, Miller, Grey and Brown determined that the single most influential factor when making decisions regarding hurricanes is the

intensity, or strength, of the storm. The higher the category, the more likely residents are to evacuate.

But risk communication has many parts, and the authors set out to find how people made decisions influenced by anxiety, past experience, confidence in hurricane protection systems, hurricane literacy, knowledge of state programs and place attachment. What they found was that the more anxious a person is about a storm, the more likely they are to evacuate or relocate. Anxiety, defined as high uncertainty over an outcome and low control over a situation, causes cognitive overload, resulting in poor decision making, meaning people may not make the smartest decisions under stress. But anxiety can also reduce risk-taking, inspiring a “better safe than sorry” approach to hazard mitigation. The authors also found that the more confidence a person has in local, state and federal protection systems, such as levees, pumps, etc., the less likely they are to evacuate or relocate. This was especially true for Category 1 and 3 storms.

H. Pilot Study Reveals NWS Flood Information Used by Many

SCIIPP partnered with three NWS River Forecast Centers (RFC) and a Weather Forecast Office in our region to develop a survey that seeks to understand, on an event basis, who is using hydrologic information, how it is being used, and whether it is effective. SCIIPP piloted the survey in Fall 2011 (n = 13) and Spring 2012 (n = 70). The results showed that almost all of the respondents (n = 61; 96.8%) used NWS flood information. Most of the respondents (n = 47; 85.5%) said they had enough information to make good decisions, and majorities agreed or strongly agreed that the floods that impacted them were predicted (n = 47; 75.8%) and forecasted with certainty (n = 38; 61.3%). Flood information sources were generally cited as being very helpful or somewhat helpful, and only a few respondents cited having problems with information sources.

This project highlighted the value of a partnership between three NWS RFCs and a university-based research team to understand and improve the effectiveness of NWS communication with its customers. SCIIPP’s role in the project is now complete; the next step is for the NWS partners to submit the tested and finalized survey to the Office of Management and Budget (OMB) for approval. With OMB approval, the NWS will be able to use this survey on an ad-hoc basis before, during, and after specific flood events so that a comprehensive study of the effectiveness of NWS hydrologic information can be completed in the future.

I. Remote Sensing Could Help Farmers Manage Crops in Zimbabwe

A visiting scientist from Zimbabwe spent four months working with SCIIPP at the University of Oklahoma (OU) and studied drought. Ms. Xolile Ncube works with Christian Care, an organization in Zimbabwe that focuses on implementing conservation farming techniques to mitigate some of the impacts of drought in the country. While at OU, Ncube worked with Dr. Xiangming Xiao at the Earth Observation and Modeling Facility to learn how remote sensing technology such as satellites can be used to understand land use in Zimbabwe and to predict early signs of drought.

Ncube analyzed data from the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite from 2000 to 2012 to understand crop conditions. The data helped her determine the health of crops on an agricultural plot in the Binga District of Zimbabwe. The data was analyzed by three crop growth stages: ascending phase (emergence and green up), plateau phase (peak growth, flowering and seed formation) and descending phase (maturity, senescence and harvesting).

The MODIS data corresponded to the documented maize crop production calendar and Ncube confirmed that three vegetation indices, Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index

(EVI) and Land Surface Water Index (SWI) are good proxies for understanding the state of vegetation at different crop growth stages.

Ncube's work showed that there is potential for using remote sensing technology as a way to monitor crop growth, especially in rural areas of Zimbabwe where observations are sparse to non-existent. The data will provide her organization with insight into the times in which they should encourage farmers to implement drought management techniques. Ncube plans to take what she learned in the United States and continue the work back home.

J. Southern Climate Monitor Newsletter

Beginning in January 2011, SCIPP launched a new monthly publication called the *Southern Climate Monitor* (see Fig. 3). The publication is a joint effort between SCIPP and colleagues at the Southern Regional Climate Center. The publication is being offered on a monthly interval through the SCIPP website to provide stakeholders and interested members of the public with a combination of summary information on climate conditions across the South Central U.S. as well as a feature article on a particular topic. The topics for the feature article are wide ranging and include such items as applied climatology, summaries of specific research projects in progress at SCIPP, analyses of a recent extreme event, discussions of current climate conditions (such as ENSO or drought), seasonal forecasts (such as hurricane outlook, winter outlook, etc.), and so on. Much of the climate summary information is compiled and written by staff at the Southern Regional Climate Center while feature articles are written by a rotation of authors throughout the SCIPP team. The publication is being treated as an experimental product to enable the *Monitor* team to allow the content to evolve with time based on user feedback. In addition to making the publication available through the SCIPP website, the *Monitor* is also sent to subscribers through an email list serve.

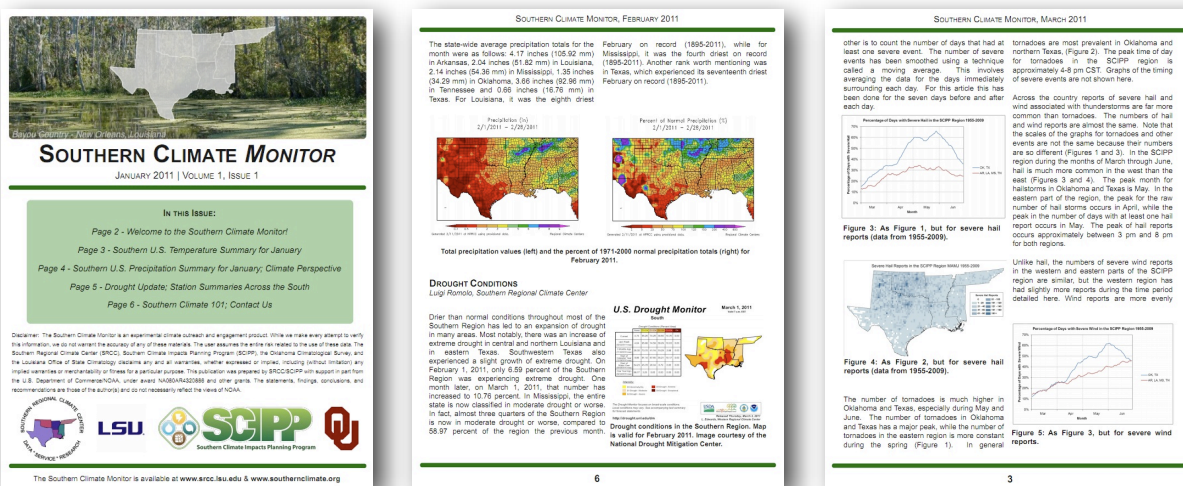


Figure 3. Sampling of the new Southern Climate Monitor publication showing the front page of the first issue (left), precipitation and drought conditions from the February issue (middle), and the feature article on storm climatology from the March 2011 issue (right).

K. Field Photos Weekend

SCIPP collaborated with CoCoRaHS to invite participants to create a national picture of our landscape on

Labor Day Weekend 2012. This was repeated over Presidents Day (2013), Memorial Day (2013) and Labor Day (2013), documenting seasonal and annual changes in the landscape. The goal of these Field Photos Weekends was to get as many observers as possible to take pictures of water bodies, fields, forests, or any other facet of our environment that they believed represented the conditions around them. It could be a picture of their favorite fishing hole, a nearby farmer's field, or a nice secluded spot amongst the trees. All of these landscapes were and are affected by rainfall, or the lack thereof.

First of all, it was wonderful to be able to appreciate nature's beauty and to be able to see the world around us. But having everyone taking pictures at approximately the same time allowed SCIPP researchers to see this landscape as it relates to the things we measure - how it compares to the amounts of rain that have fallen or if it looks like we might expect according to the U.S. Drought Monitor. Is the land around you as green as the satellite seems to think?

SCIPP hopes this will become a somewhat regular event. So while the weather around participants may seem normal this year, these photos should give everyone a point of reference for what is maybe different next year or in another season. SCIPP provided guidance to participants on taking photos to tell the story of the field or landscape, anything that the participants felt was representative of the world around them. SCIPP wanted to see what it would look like walking through a field, where some things were in better condition than others. So if the participants saw a dead tree, a bunch of trees that were dropping some leaves, and a heavily watered tree with lush green leaves, we wanted the picture showing the ones dropping leaves.

Photo ideas included:

- A. A water body, showing how much water it was holding and where the natural bank might be. For example, a farm pond showing the ring of bare soil around it that is usually submerged.
- B. A tree, showing the health of its leaves. It could be a tree in the front yard, one in a nearby park, or something over in the woods, whatever they think tells the story about how it is faring this year.
- C. A field, such as a pasture, meadow, or crops. The photo should show whether vegetation is brown or green, if soil is becoming exposed, if seeds are burnt up, or if vines are withering.
- D. A panorama, or series of pictures from a single spot looking in each direction (north, east, south, and west - and down!). The panorama is a good way to get a "big picture" of the land around the observers, especially if they think they might participate in another Field Photos Weekend in the future.

To create this archive, SCIPP and CoCoRaHS partnered with the Earth Observation and Modeling Facility (EOMF) at OU. EOMF hosts an international field photos archive, satellite imagery, and landscape models. The addition of nearly 1,000 simultaneous images on each of these weekend events expands the "ground truth" data available to researchers studying landuse and land cover change. Photos uploaded during both Field Photos Weekend are located at the Earth Observation and Modeling website: <http://www.eomf.ou.edu/photos>.



Figure 4: A few of the photos that were submitted during the Field Photos Weekend, Labor Day 2011.

L. Seasonal Climate Workshop

Federal and state climate scientists, decision makers, and communication experts gathered in Norman, Oklahoma on 27 September 2012 to discuss the ways in which seasonal climate information should be communicated to various audiences. Drought information was the focus of much of the discussion because the Southern Plains had recently experienced a drought of significant magnitude and vast extent. All seasonal climate information was relevant to the workshop, however.

The purpose of this workshop was to bring together climate scientists, decision makers and communication experts to discuss the methods that were used to communicate drought information in the Southern Plains during 2011-2012 and to determine the areas in which scientists can improve their communication of seasonal climate information. The discussion focused on several topics including tips for managing webinars, useful products, product deficiencies, communication challenges, the role of social media, and several unresolved issues. The workshop was organized by SCIPP, the National Integrated Drought Information System (NIDIS), and the NOAA Southern Regional Climate Services Director. Seventeen people participated in total.

The decision makers were interested in the science as long as it is in a format that is easily accessible and that some materials could be used for 5-15 minute briefings with their colleagues. Climate information and products are often used as evidence to a governing board, state agency, or the public for why a particular decision is being made, so it is important that it is displayed and formatted in a way that effectively and accurately communicates the data. Moreover, improving the connection between statistics and impacts will help decision makers better understand what to do with the information. The participants also agreed that building relationships between decision makers, information providers and the media is one of the most effective ways to ensure that scientific information is portrayed appropriately and accurately. Traditional and social media should be viewed as a strategic partner, not an adversary. Climate science information is complex but that should not deter scientists from communicating in a way that is relevant to decision makers and via various media platforms. The information that is communicated through these channels helps society manage the impacts of climate hazards such as droughts, floods, and heat waves.

6. SCIPP Phase I Focus Points

A. SCIPP Data Products/Climate Tools

During the past five years, several new climate information tools were developed by the SCIPP team and

evaluated with the help of stakeholder feedback. These include the Historical Climate Trends Tool (Fig. 5), Climograph Tool (Fig. 5), and Historical Coastal Surge Map (Fig. 5) powered by the SURGEDAT database. All are available on the SCIPP webpage in the data products section (<http://www.southernclimate.org/data.php>) as experimental tools. The motivation for many of these new products was largely driven by stakeholder and user requests provided to the state climate offices over the years. A webinar was held in the fall of 2010 to have a select set of users provide feedback on the tools, and additional feedback was solicited from the climate community through the American Association of State Climatologist list serve.

These products were developed by and hosted on Southern Regional Climate Center servers. In this way, should products be useful, they can be easily entered into an operational environment on the SRCC website or other NOAA servers.

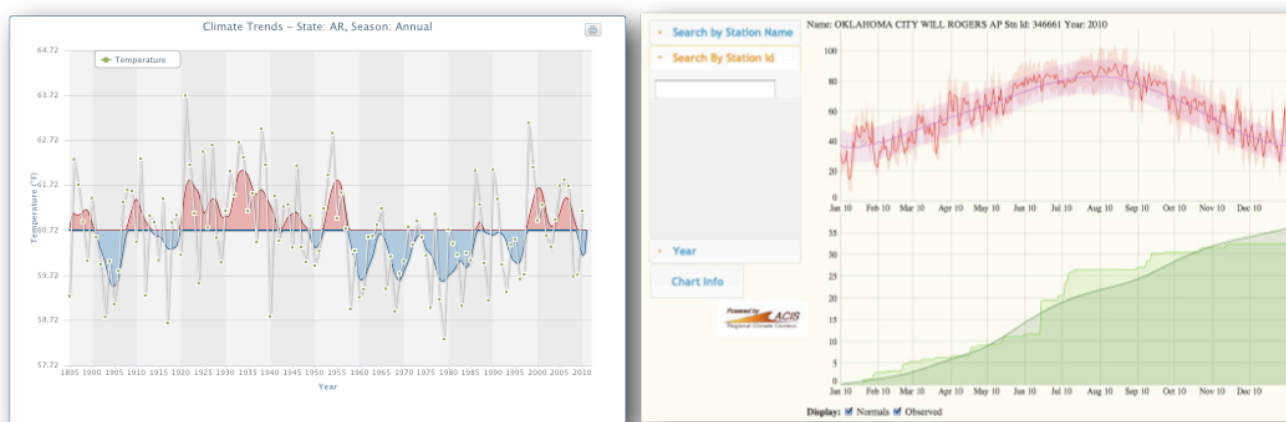


Figure 5. New SCIPP climate tools: the Historical Climate Trends Tool (left) and Climograph Tool (right).

B. Adaptation Planning

1. Oklahoma Climate Adaptation Planning

In partnership with the Oklahoma Climatological Survey (OCS), SCIPP co-hosted a climate adaptation planning kick-off meeting in December 2009. This initial meeting, which brought together decision-makers from state agencies, tribal nations, cities, federal agencies, and academia, was a first step in establishing an open, state-level dialogue focused on climate adaptation in Oklahoma. The meeting included an introduction to the concept, a scientific overview of climate change, and a summary of climate adaptation planning activities elsewhere in the U.S. Following these activities, attendees participated in a World Cafe-style break-out session in which participants were asked to provide organizational perspective on a series of climate needs-related questions. In addition to this meeting, a special half-day morning meeting was held exclusively for tribal officials to foster relationship building and allow an opportunity for closer initial engagement. Future activities will likely involve



Figure 6 (above). December 10, 2009 Climate Adaptation Planning Kick-off Meeting.

additional meetings as well as the establishment of sector-focused working groups. OCS is serving as the lead agency in this state-level effort while SCIPP is focusing on the learning aspect of the process to help support similar activities elsewhere in the SCIPP region.

2. Oklahoma Inter-Tribal Meeting

SCIPP, in collaboration with Haskell Indian Nations University and the Oklahoma Climatological Survey, and supported in part by the U.S. Global Change Research Program and the National Aeronautics and Space Administration, hosted a meeting on climate variability and change with Oklahoma tribal representatives on December 12, 2011. The meeting took place at the National Weather Center in Norman, Oklahoma. Oklahoma is home to 39 tribal nations and this meeting provided them with the opportunity to offer input to be included in the 2013 National Climate Assessment (NCA). Of the seventy-three people that participated in the meeting, 42 represented Oklahoma tribes (21 tribal nations were represented). Two participants from a tribe in Texas also attended. Furthermore, three out of the four tribal colleges in Oklahoma were represented. The majority of the tribal participants were employed by their tribe's environmental department, although a few tribal leaders were also in attendance. The purpose of the meeting was to 1) enhance and foster dialogue between tribal representatives and climate scientists that was previously initiated through two statewide meetings in which tribal representatives were invited and some attended, 2) educate tribal representatives about climate science and climate change, and 3) develop recommendations for material to be included in the 2013 NCA document. A summary report is available on the SCIPP website: http://www.southernclimate.org/publications/Oklahoma_Intertribal_Climate_Change_Meeting.pdf

One of the discussion points raised in the meeting was the need for basic climate education in the context of tribal environmental management issues and tribal culture. This led to collaborative development, with the Chickasaw Nation of a proposal to adapt the Oklahoma Climatological Survey's "Climate 101" workshops to a specific tribal context. The project was selected for funding in Fall 2013.

C. Drought Planning and Response

1. South Central U.S. State Drought Planning Workshop on May 11-12, 2011 in Memphis, TN

In May 2011, state drought planners along with the Southern Climate Impacts Planning Program (SCIPP), the National Drought Mitigation Center (NDMC), NOAA and National Integrated Drought Information System (NIDIS), convened a meeting to discuss drought planning at the state level. Within the 6-state region served by SCIPP, three states (Louisiana, Arkansas and Mississippi) have no drought plans and Oklahoma's is more than ten years old (adopted in 1997). To encourage them to create or update plans, SCIPP hosted a drought planning workshop, convened, ironically, in Memphis during the peak of the Mississippi River flooding.

In preparation for the workshop, SCIPP identified current or potential leadership on drought issues within each state. These officials were invited to the regional workshop along with drought experts in their respective states, particularly the State Climatologists and representatives from the Southern Regional Climate Center. In addition, national experts from NDMC, NOAA and NIDIS attended and presented on a range of topics from the Drought Monitor development process to planning resources.

Workshop goals were to:

- 1) Introduce participants to the Drought Monitor process and NIDIS;
- 2) Briefly discuss strengths and weaknesses of various monitoring tools;
- 3) Provide examples of good structure of state drought plans, including monitoring, communication, impact reporting and connections to local communities; and
- 4) Give them ample time to work with "experts" in outlining elements of their own (future) state plans.

Challenges and opportunities identified during the workshop included a need for more monitoring tools and predictions; more analysis and coordination between sectors and agencies, even in the best-prepared states; integrating drought into state water and hazard plans; and revisiting who and what agencies were involved in the original plan and any necessary changes. A particular challenge was noted by one of the Mississippi participants: "In the West, they have spent 150 years trying to move water to where it is needed. In the Mississippi Delta, we've spent 150 years trying to move water away."

Outcomes from the workshop laid a firm foundation for further collaboration. Participants learned from each other. There was as much conversation among the state participants as there was between them and the "drought experts." Attention was paid to the diversity of local sectors and resources. Most importantly, participants now know counterparts working with drought issues in nearby states and sources of expertise in regional and national organizations. Several members participated in additional, national meetings and are working to improve drought management even in places where a formal planning process is in its infancy. SCIPP remains engaged with these participants, helping them identify counterpart plans, conduct surveys of agencies, and collect drought impacts information.

2. Managing Drought in the Southern Plains Webinar Series

A drought of strong intensity and vast geographical extent gripped the South Central United States throughout 2011. As early as November 2010, the NOAA Climate Prediction Center predicted that eastern Pacific La Niña conditions would increase the potential for drought formation across the southern United States. In fact, the state of Texas set its driest water year (October 2010-September 2011) on record. To respond to these severe ongoing conditions, multiple efforts were launched to engage decision-makers from regional to state to local arenas in a conversation about drought.

Communication among agencies and affected sectors is a key to successful management. Towards this end, SCIPP, in collaboration with the National Integrated Drought Information System (NIDIS), NOAA Regional Climate Services Director, National Drought Mitigation Center (NDMC), Climate Assessment for the Southwest (CLIMAS), and the region's State Climatologists, launched a four-pronged approach to assure that all of these arenas were addressed: regional forums, state drought planning, a series of webinars and supporting local impact reporting. The net effect of these efforts is that interaction between these arenas and between the academic and practitioner communities increased substantially. Many decision-makers have participated in multiple activities, such as state drought planners attending the regional forums or local Farm Service Agency offices participating in the drought webinars and impact reporting.



Figure 6: Managing Drought in the Southern Plains flyer.

While in many instances the response to the drought has remained reactive, these discussions have yielded a treasure trove of information that will form subsequent development of best practices guidelines, improve drought planning, and connect state and local monitoring more closely.

SCIPP, in conjunction with the NOAA Regional Climate Services Director for the Southern Region, the National Integrated Drought Information System (NIDIS), the National Drought Mitigation Center (NDMC), and the American Association of State Climatologists (AASC), have hosted a series of forums, workshops, and webinars to address the current drought situation in the southern plains and promote planning and preparation for future drought conditions.

This *Managing Drought in the Southern Plains* initiative brought together various state and local agencies, federal officials, and many others tasked with managing drought conditions. To date, there have been 21 drought focus topic webinars.

Along with focus topic webinars, SCIPP started producing a shortened, 5-minute weekly briefing in May 2012. To date, 42 drought briefings are available for viewing on SCIPP's website and YouTube. Between the briefings and focus topic webinars, there have been 5,580 views on YouTube. By shortening these briefings, SCIPP hopes that they will be easier to use as decision makers find the need and opportunity. Likewise, SCIPP provides a weekly newsletter announcing the availability of the webinar for viewing, along with relevant drought graphics from sources such as the U.S. Drought Monitor, the Climate Prediction Center, the U.S. Department of Agriculture, and others.



Figure 7: (Left) West Texas Drought Outlook and Assessment Forum in Abilene, TX and (Right) Spring 2013 Southern Great Plains Drought Outlook and Forum in Goodwell, OK.

D. Communities and Collaboration

Collaborative Project: Mandeville, Louisiana

SCIPP has been working with Louisiana Sea Grant on a project with the city of Mandeville, Louisiana (which is located on the northern coast of Lake Pontchartrain) on sea level rise issues. Three workshops with Mandeville, Sea Grant, and SCIPP have been held with an additional meeting in the works for city and parish government officials on several issues related to sea level rise. The first workshop featured a presentation by Lynne Carter on the science behind sea level rise, as well as a talk from deEtte Smythe, an engineer from St. Tammany Parish, on what steps the parish is taking to address relative sea level rise. The second workshop focused on using geographic information systems data to evaluate storm surge and sea level rise risks, and the legal issues local governments will face as they learn more about how hazards can impact their community. The third workshop focused on risk communication. A fourth workshop featured

Shirley Laska from University of New Orleans and Camille Manning Broome from the Center of Planning Excellence. SCIPP has participated in the planning and carrying out of the entire series of workshops and has provided information on how to approach these issues as well as consideration of increases in temperature and changes in precipitation as well as sea-level rise. City and parish officials as well as Louisiana Coastal Zone Management program representatives and other NOAA groups (e.g. National Estuarine Research Reserve System) have been regular participants and will receive a sea level rise tool kit and information on how to best adopt sea level rise planning into their decision making process.



Figure 8: Part of City of Biloxi, MS handout on climate change.

The **City of Biloxi, MS** invited SCIPP researcher Dr. Lynne Carter to present about *Climate Changes - How to Be More Ready*. The **City of Biloxi, MS** also recently created a handout that incorporated climate change information from SCIPP. This handout was mailed to Biloxi, MS residents.

SCIPP Investigators Barry Keim and Hal Needham introduced SCIPP's unique SURGEDAT dataset for possible use and collaboration in vulnerability assessments in Houston and Galveston, around New Orleans, and by the **U.S. Department of Energy**.

SURGEDAT was also a focus topic at the **Lake Pontchartrain Basin Foundation** round-table meeting in the summer of 2012. SCIPP researcher Hal Needham met with people concerned about the **New Orleans Flood Protection System**. This round table included people from the U.S. Army Corps, Levee Boards, and Red Cross.

Hal Needham also gave a seminar at **Texas A&M Galveston** in October of 2012. This seminar focused on our storm surge research. The audience was very interested in the information since the group is proposing to build an Ike Dike along the Texas Coast.

The city of **Austin, TX** is among several cities selected to serve as a pilot engagement city. One of the opportunities that emerged following initial contact was involvement in a process to develop a community climate action plan. The development of the plan - which is being led by the Austin Climate Protection Program with support by Austin Energy - was formally launched in March 2010 through a kick-off meeting held at Austin City Hall. Attendees at the meeting included local area leaders from a variety of organizations representing non-profits, real estate, business, education, utilities, and others. Five SCIPP team members attended the meeting to become immersed in the 1.5 day-process which included a combination of full group and break-out group activities. SCIPP also provided an opening scientific presentation that helped the community to recognize changes already occurring and changes projected. A series of side meetings between SCIPP and city representatives in emergency management, energy, and utilities were also held. Better understanding community-level needs related to this planning process is one of the key aspects of this project.

E. Assessments: Oklahoma, Gulf Coast, and National Climate

SCIPP has been an active contributor to the NCA process. To provide regional context, SCIPP conducted two needs assessments (Oklahoma and the Gulf Coast) and participated in the technical input reports for

the Great Plain and Southeast Regions. During this past year, SCIPP has remained involved as Convening Lead Authors on the Great Plains (Mark Shafer) and the Southeast and the Caribbean (Lynne Carter) chapters. Lynne also serves as a Lead Author on the Adaptation chapter and as a member of the FAC for ongoing leadership of the Assessment process. SCIPP has promoted engagement with the NCA process through meetings and webinars throughout the two regions and nationally.

During this process, SCIPP has looked at a vast array of climate-related challenges to the region. In the Southeast, this includes seas level rise; the effects of rising temperatures on public health, natural and built environments, energy, agriculture and forestry; and decreased water availability in the context of population growth and land use change.

Key challenges for the Great Plains revolve around competition for water and its impact on energy production, natural resources, agriculture and development; changes in crop growth cycles due to warming winters and changes in precipitation patterns; the effects of landscape fragmentation on adaptation of species; extreme events impacts on vulnerable communities; and enormous needs for adaptation and planning that dwarf anything the region has previously experienced, including the Dust Bowl.

Reviews of the adaptation literature and examples revealed a path forward. Substantial adaptation planning is occurring in the public and private sectors and at all levels of government, however few measures have been implemented and even those that have appear to be incremental changes. Although there is no “one-size-fits-all” adaptation, there are similarities in approaches that can help support progress and overcome impediments. They also revealed the need for more systematic evaluation of climate change adaptation and the need to examine adaptation in the context of other societal goals, such as sustainable development, disaster risk reduction, or improvements in quality of life.

SCIPP will continue to participate in completion of the 2013 report and in the ongoing assessment process.

1. Oklahoma climate needs assessment shows that most sector planning horizons focus on 15 years or less

The Oklahoma climate needs assessment, which began in late 2010, was completed in February 2012. The assessment was based on input from decision makers in 23 local, tribal, state, federal, non-profit, and for-profit agencies across Oklahoma in the following sectors: agricultural production, ecosystems, energy, health, society/public safety, transportation, and water resources. The data revealed the most significant climate-related issues that Oklahoma decision makers are currently facing and anticipate they will face in the future, the spatial and temporal scales in which they make decisions, and their need for climate information, education, and decision-support tools.

The findings demonstrate that climate had an enormous impact on the sectors in which the decision makers worked. The participants stated that flash floods and droughts, ice and snow storms, water resource issues, and tornadoes create the most significant climate-related issues. Many decision makers use weather and/or climate information on a daily or a weekly basis, and especially during extreme or high impact events. The decision makers said their most significant climate change-related issues will arise from more intense but less frequent rain events because an increased chance of floods and drought is problematic for many agencies.

The bulk of the participants in this study said their maximum planning timescale was less than 15 years. The exceptions were the transportation and water resources sectors, which generally plan out to 50 and

100 years respectively. Spatially, local weather data is used for the majority of short-term decisions. For longer planning horizons where climate model projections would be relevant, the participants generally agreed that grid spacing that breaks the state into 4 to 5 regions would be sufficient. Several research, data, and educational needs were identified during this study. Meeting these needs would provide decision makers with climate information that is relevant to their planning horizons and the multi-faceted nature of their work.

2. Gulf Coast Needs Assessments Reveals Hurricanes and Storm Surge Hazards have the biggest impact

More than 60 in-person interviews have been conducted along the western Gulf of Mexico as part of the Gulf Coast Assessment, including much of the Texas coast (Houston/Galveston region in particular) as well as Louisiana to include representative interviews along the TX, LA, and MS coasts. The goal of the Gulf Coast Assessment is very similar to the Oklahoma assessment and focuses on climate data needs for coastal stakeholders, perceptions of climate change, and use of climate projections and models. This assessment places a more significant emphasis on place-based analysis than the Oklahoma Assessment, due in large part to the multi-state region of study. Survey participants included representatives of 13 professional sectors, including about 1/3 who were Emergency Management/Homeland Security or Operations personnel. Planners at various community levels represented roughly 16%, and others included agriculture, fishing, permitting, local government, environment, coastal resources, healthcare, and more. As part of the interviews, the SCIPP team provided a series of educational handouts focused on temperature, precipitation, and sea-level rise. Each handout is a two-sided publication that provides information about observed and projected changes for those three climate drivers.

Not surprisingly, the research has revealed that storm surge and hurricanes are the hazards with the biggest impact on the coast, while sea-level rise is an issue that stakeholders expect to become a bigger threat in the future. The engagement has also provided insight into the complex relationship between rainfall runoff and sea levels, as many stakeholders have indicated that heavy rainfall events do not drain well when sea levels are high or because of onshore winds. This finding reveals that even a slight rise in sea level could have serious impacts (such as reduced drainage rates), which could negatively impact coastal communities long before actual sea levels inundate the coast directly.

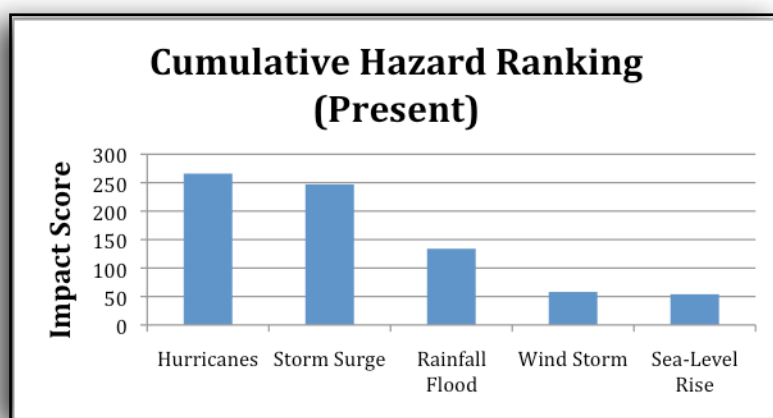


Figure 9: Cumulative Hazard Rankings by coastal stakeholders. Higher points mean the hazard is perceived as a greater threat.

7. Graduate Student Research

This is a compilation of the graduate research completed during Phase I of SCIPP.

A Comparative Study of Drought Management in Oklahoma and Missouri (Campbell, Shafer, Crawford)

A Quantitative Description of the Urban Heat Island in Oklahoma City (Schroeder, Shafer)

Analyzing Past Drought and Predicting Future Drought with Comprehensive Drought Indices for the Arkansas-Red River Basin (Liu, Hong, Carter, Hocker, Shafer, Gourley)

Cascading Events: Diversified Investment Analysis Relating to Business Resilience (Zhen, Shafer)

Dry Event Trends and Frequencies in the South Central United States (Roberts, Keim)

Emergency Managers: Decision-making and Uncertainty (Erickson, Shafer)

Ice Storm Frequency Across the United States in Response to changes in the El Niño Southern Oscillation (ENSO), Arctic, and North Atlantic Oscillations (Kovacik, Hocker, Shafer)

Identifying Historical Storm Surges and Calculating Storm Surge Return Periods for the United States Gulf Coast (Needham, Keim)

Lone Grove Tornado Warning Response (Erickson, Shafer, Hocker)

Mechanisms of Urban Influence on Precipitation in the Southeastern United States: Detection, Storm Bifurcation, and Synoptic Characteristics (Trevino, Brown)

Ocean-Atmosphere Interaction Between the Gulf of Mexico Sea Surface Temperatures and Northern Gulf Coastline (Becker, Keim)

Past 25 years show weak teleconnections between summer drought and winter ENSO over the southern United States (Liu, Hong, Carter, Hocker, Shafer)

Rights, Regulations and Water: Value Clashes of Groundwater Users in the High Plains Groundwater Conservation District (Pavlowsky, Shafer)

The Impacts of Climate Change and Variability on the Surface Water Budget in the Southeast United States (Billiot, Keim)

Tree Mortality After High Wind Events Based on Previous Weather Conditions (Becker, Keim)

Trends in Heavy Precipitation in the SCIPP Region of the Southern USA (White, Shafer, Hocker)

Using GIS to Assess Vulnerability to Climate Hazards in the Southern United States (Gottlieb, Shafer)

What Factors Determine the Public Perception of Global Warming, Science, Scientists, or Weather? (Shao, Keim)

8. Presentations

Another major accomplishment of the SCIPP is presenting the relevant climate information and studies to our stakeholders and stakeholder communities. Below is a list of all SCIPP presentations conducted over the period September 2008 to December 2013.

2008:

"Hurricanes." Presented for the Nicholls State University Forum Series, October 28, 2008 (Barry Keim).

2009:

"A National Climate Service: Why Now?" Keynote presentation at the Northern Gulf Institute annual meeting, Mobile, AL, May 2009 (Carter).

"Climate Change: Fact or Fiction." Presented for the Agricultural Leadership Program, LSU, Baton Rouge, LA, January 6, 2009 (Barry Keim).

"Climate in the Great Plains." Presentation at the Native Peoples, Native Homelands Climate Change Workshop II, Prior Lake, MN, November, 2009 (Carter).

"Customer-driven User Services." Presentation to the NOAA Climate Working Group, Broomfield, CO, July 13-15, 2009 (Robbins).

"Global Climate Change Impacts in the United States." Hawaii Conservation conference, speaker on coastal and adaptation issues, Honolulu, HI, July 2009 (Carter).

"Gulf Hurricanes" Presented to the Adult Class, Contemporary Christian Concerns, University Methodist Church, Baton Rouge, July 2009 (Keim).

"Hurricanes in a Changing Climate." Presented at the 25th Annual Louisiana Remote Sensing and GIS Workshop, Baton Rouge, LA, April 14, 2009 (Barry Keim).

"Hurricanes of the Gulf South." Presented at the LSU College of Arts and Sciences Spring Luncheon, New Orleans, LA, March 12, 2009 (Barry Keim).

"Hurricanes of the Gulf of Mexico." Presented at the Louisiana Book Festival, Baton Rouge, LA, October 17, 2009 (Keim).

"Hurricanes in the Southeast." Presented to the Department of Earth Sciences, University of Texas-Arlington, October 1, 2009 (Keim).

"Hurricane Risks in Louisiana." Presented at the Louisiana Senate - Natural Resources Committee Meeting, Baton Rouge, LA, December 17, 2009 (Keim).

"Knowledge and Action: The Role of Social Sciences." Presented at the Research Experience for Undergraduates Program, Norman, OK, June 30, 2009 (Shafer).

"Managing Drought in a Multi-Hazard Context: Overview of the new SCIPP RISA program." Presented at the NOAA Climate Board Meeting, February 27, 2009 (Mark Shafer).

"Southern Climate Impacts Planning Program (SCIPP)." Presented to Southern Region NOAA River Forecast Centers, Norman, OK, November 6, 2009 (Hocker).

"Southern Climate Impacts Planning Program (SCIPP)." Presented at the 6th U.S. Drought Monitor Forum, Austin, TX, October 8, 2009 (Shafer).

"Southern Climate Impacts Planning Program and Sustainability Studio." Presentation to Louisiana Marine Extension Agents, quarterly meeting, LSU, August 2009 (Carter).

"The Opportunities of Climate Change." Presented to the Norman Chamber of Commerce Weather Committee, Norman, OK, July 21, 2009 (Shafer).

"World Cafe Exercise." Presented at USGS/Fish and Wildlife Service Western Gulf Coast and Southern Plains Climate Workshop, Austin, TX, August 11, 2009 (Hocker, Carter).

2010:

"2010 Hurricane Risks in Louisiana." Presented at the annual ENTERGY Hurricane Preparedness Meeting, Baton Rouge, LA, May 24, 2010 (Keim).

"A Comparative Study of Drought Management in Oklahoma and Missouri." Presented at the 90th annual meeting of the American Meteorological Society (AMS), Atlanta, GA, January 20, 2010 (Campbell).

"A Framework for Investigation of Urban Influence on Precipitation and Storm Bifurcation in the

Southeastern United States.” Presented at the 106th Annual Meeting of the Association of American Geographers (AAG), Washington, D.C., April 16, 2010 (Trevino).

“A Geographer’s Perspective: Hard and Soft Scientists Can Work Together.” Presented at the 80th Annual Meeting of the Southern States Communication Association, Memphis, TN, April 10, 2010 (Brown).

“An Analysis of Historical Storm Surge Activity Along the U.S. Gulf Coast.” Presented at the 1st National Flood Workshop, Houston, TX, October 24-26, 2010 (Needham).

“An Investigation of Urban Influence on Precipitation in the Southeastern United States: Enhancement, Bifurcation, and Synoptic Characteristics.” Presentation at Applied Geography Conference, Fort Worth, TX, October 2010 (Trevino).

“Analyzing Projected Changes and Trends of Temperature and Precipitation in the Southern U.S. from 16 Downscaled Global Climate Models under Different Emission Scenarios.” Poster presented at TeraGrid 2010, Pittsburgh, PA, August 2-5, 2010 (Liu).

“Assessing Climate Change Impacts on the Blue River Basin of Oklahoma.” Poster presented at 2010 Oklahoma Governor’s Water Conference, Norman, OK, October 26-27, 2010 (Liu).

“Bridging the Gap Between Climate Science and Decision Making: the RISA Program and an Overview of SCIPP.” Guest lecture in Dr. Yang Hong’s class - Climate Change and Natural Hazards Class (Hocker).

“Calculating Storm Surge Return Periods for Coastal Locations on the Gulf of Mexico.” Presented at 29th Conference on Hurricanes and Tropical Meteorology, Tucson, AZ, May 10-14, 2010 (Needham).

“Challenges Associated with Classifying Urban Meteorological Stations: the Oklahoma City Micronet Example.” Presented at the 15th Symposium on Meteorological Observations and Instrumentation, 90th AMS Meeting, Atlanta, GA, January 20, 2010 (Schroeder).

“Climate Changes Now and Later: Considerations for Design and Planning.” Presented at the Louisiana Chapter American Society of Landscape Architects Annual Conference, New Orleans, LA, February 2010 (Carter).

“Climate Division Precipitation Anomalies Under a Varying PDO Diagnostic Framework.” Presented at the 106th AAG Meeting, Washington, D.C., April 16, 2010 (Yost, Brown).

“Climate Variability of the Great Plains.” Presentation at U.S. Bureau of Reclamation Climate Change meeting, Denver, CO, February 3, 2010 (McManus).

“Crisis Knowledge and Preparedness after Katrina as a Function of Race.” Poster presented at the Alabama-Mississippi Bays and Bayous Symposium, Mobile, AL, December 2010 (Edwards).

“Developing a Baseline for a RISA Program: SCIPP’s Natural Hazards and Climate Change Planning Survey.” Presented at the 90th AMS Meeting, Atlanta, GA, Jan. 21, 2010 (Hocker).

“Dry Event Trends and Frequencies in the South-Central United States.” Presented at the 106th AAG Meeting, Washington, D.C., April 16, 2010 (Roberts, Keim).

“GIS Development of the Southern Climate Impacts Planning Program.” Presented at the 90th AMS Meeting, January 19, 2010 (McPherson).

“GIScience Approaches to Understanding Geographic Dynamics.” Presented at GIS Day at the University of Nebraska, Lincoln, NE, November 17, 2010 (Yuan).

“Hurricanes of the Gulf of Mexico.” Presented at the 106th AAG Meeting, Washington, D.C., April 16, 2010 (Keim, Muller).

“Hurricanes, Institutional Procedures, and Information Processing.” Presentation at the annual meeting of the National Coastal Storms Program Team (NOAA), Ocean Springs, MS, May 2010 (Edwards).

“Knowledge and Action: The Role of Social Sciences.” Presented to the Research Experience for Undergraduates program, Norman, OK, June 9, 2010 (Shafer).

“Lessons Learned: Evacuations Management of Hurricane Gustav.” Presented at the Digital Hurricane Consortium: Field Planning and Impacts Workshop, Norman, OK, June 28, 2010 (Shafer).

“Lone Grove, Oklahoma February Tornado: Response, Impacts and Lessons Learned.” Presented at the 90th AMS Meeting, Atlanta, GA, January 21, 2010 (Erickson).

“Oklahoma Climate Adaptation Efforts, Regional Climate Change.” Regional Climate Conference on Monitoring, Modeling, Predicting and Impacts, Norman, OK, February 9, 2010 (Shafer).

Panel Presenter at “State of the Coast: Implementing a Sustainable Coast for Louisiana,” in session: *Adapting Natural and Built Environments to a Changing Climate*, Baton Rouge, LA, June 9, 2010 (Carter).

“Planning to Protect: Helping Southeast Communities Think about Climate Change and Adaptation.” Inaugural speaker for the Southern Alliance for Clean Energy (SACE) and ICLEI: Local Governments for Sustainability launch of monthly webinar series, January 28, 2010 (Carter).

“Planning to Protect: How We Might Think About A Changing Climate and Be More Ready.” Presented at the Local Coastal Program’s 3rd Quarterly Meeting, Baton Rouge, LA, March 25, 2010 (Carter).

“Planning to Protect: How We Might Think About A Changing Climate and Be More Ready.” Plenary Panel at Restore America’s Estuaries, 5th National Conference, Galveston, TX, November 15, 2010 (Carter).

“Planning to Protect: How We Might Think about A Changing Climate and Be More Ready.” Presented at the City of Austin, TX Climate Planning Workshop, March 4, 2010 (Carter).

“Planning to Protect: Thinking About Climate Change and Adaptation.” American Planning Association Annual Meeting, panel presentation, New Orleans, LA, April 10, 2010 (Carter).

“Planning to Protect: Thinking About Climate Change and Adaptation.” Prowalk/Probike Annual Conference, Chattanooga, TN, September 14, 2010 (Carter).

“Planning to Protect: How We Might Think About A Changing Climate and Be More Ready.” CPEX Smart Growth Conference, Baton Rouge, LA, August 20, 2010 (Carter).

“Planning to Protect: How We Might Think About A Changing Climate and Be More Ready.” National Park Service Webinar Series presentation, August 12, 2010 (Carter).

“RCC and RISA Partnerships for Research to Operations Development.” Presented at the 90th AMS Meeting, Atlanta, GA, January 21, 2010 (Robbins).

“Scientific Assessments: What Good are They?” Presented at the University of Oklahoma Department of Geography Sustainability Seminar Series, Norman, OK, September 10, 2010 (Shafer).

“Southern Climate Impacts Planning Program: Hazards & Risk Awareness Survey.” Presentation to the Risk and Crisis Center’s Community Advisory Board biannual meeting, Norman, OK, May 7, 2010 (Hocker).

“Themes from Interviews with Decision-makers about Hurricane-Related Communication.” Panel discussion at the 80th Annual Meeting of the Southern States Communication Association, Memphis, TN, April 9, 2010 (Brown et. al).

“University of Oklahoma International Collaboration.” Presented at USDA-China MOST Climate Change Workshop, San Diego, CA, November 9, 2010 (Shafer).

“Update on SCIPP’s Southern U.S. Hazards and Climate Change Planning Survey.” Presentation to the Risk and Crisis Center’s Community Advisory Board biannual meeting, Norman, OK, December 7, 2010 (Hocker).

“Variability of Rainfall from Tropical Cyclones in the Eastern United States and its Relation to AMO and ENSO.” Presented at the 106th AAG Meeting, Washington, D.C., April, 2010 (Noguiera, Keim, Brown).

“Vulnerabilities and Impacts: A New Paradigm for Research.” Presented at the Regional Climate - Monitoring, Modeling, Predicting, and Impacts Conference, National Weather Center, Norman, OK,

February 9, 2010 (Carter).

"What Factors Determine Public Opinion of Global Warming?" Presented at the 106th AAG Meeting, Washington, D.C., April 17, 2010 (Shao).

2011:

"2011 Hurricane Season." Presented to the Baton Rouge Press Club, Baton Rouge, LA, June 6, 2011 (Keim).

"A Look Back at Major Disaster Declarations: A GIS Perspective." Presented at the 91st annual meeting of the American Meteorological Society, Seattle, WA, January 24, 2011 (Hocker).

"A System to Support Hazard Mitigation Planning in the South." Presented at FEMA Region 6 Mitigation Conference, Denton, TX, May 3, 2011 (Hocker).

"An Analysis of Historical Storm Survey Activity Along the U.S. Gulf Coast." Presented at the annual meeting of the Association of American Geographers, Seattle, WA, April 13, 2011 (Needham).

"An Analysis of Southern U.S. Ice Storm Frequency from 2000-2009." Presented at the 91st annual meeting of the American Meteorological Society, Seattle, WA, January 26, 2011 (Kovacik).

"An Analysis of Storm Surge Activity Activity Along the U.S. Gulf Coast." Presented at the SSPEED Program Workshop at Rice University, Houston, TX, January 28, 2011 (Needham).

"An assessment of the climate-related needs of stakeholders in Oklahoma." Presented at Practical Solutions for a Warming World: AMS Conference on Climate Adaptation, Asheville, NC, July 18-20, 2011 (Riley).

"Analyzing Past Drought and Predicting Future Drought with Comprehensive Drought Indices for Arkansas-Red River Basin." Poster presented at AGU Chapman Conference on Climates, Past Landscapes, and Civilizations, Sante Fe, NM, March 21-25, 2011 (Liu).

"Analyzing Past Drought and Predicting Future Drought with Comprehensive Drought Indices for Arkansas-Red River Basin." Poster presented at the Symposium on Data-Driven Approaches to Droughts (DDAD2011), West Lafayette, IN, June 21-22, 2011 (Liu, Hong, Hocker).

"Climate Adaptation Planning to Aid State, Municipal, Tribal, and Federal Governmental Decision Makers." Presented at the 91st annual meeting of the American Meteorological Society, Seattle, WA, January 24, 2011 (McPherson).

"Climate Change." Presented at the Ag Leadership Conference, Baton Rouge, LA, January 4, 2011 (Keim).

"Climate Change Impacts on Water Availability and Hydrological Extremes: Case Studies from Southern USA and Emerging Regions." Presented at the Department of Geography and Environmental Sustainability, Colloquium Series, University of Oklahoma, Norman, OK, April 1, 2011 (Hong).

"Climatological Drought Analyses and Projection with SPI and PDSI: A Case Study for Arkansas-Red River Basin." Presented at the International Symposium on Earth-Science Challenges, Norman, OK, September 15, 2011 (Liu, Hong, Hocker, Shafer).

"Climatological Drought Analyses and Projection with SPI and PDSI: A Case Study for Arkansas-Red River Basin." Poster presented at the 2nd International WaTER Conference, Norman, OK, October 24-25, 2011 (Liu, Hong, Hocker, Shafer).

"Developing a System to Support Hazard Mitigation Planning in the South: Process and Lessons Learned." Presented at 9th Annual Climate Prediction Applications Science Workshop, Des Moines, IA, March 3, 2011 (Hocker).

"Developing a System to Support Hazard Mitigation Planning in the South." Presented at the 2011 FEMA Region VI Mitigation Conference, Denton, TX, May 2, 2011, Denton, TX (Shafer, Hocker).

"Engaging Oklahoma Decision-Makers to Produce a Climate Needs Assessment for the State." Presented at the 9th Annual Climate Prediction Applications Science Workshop, Des Moines, IA, March 4, 2011 (Riley).

“Global and Regional Flood, Landslide and Drought Monitoring and Prediction.” Key Note Speaker at the International Water Conference, Nanjing, China, November 28-December 2, 2011 (Hong).

“How and Where to Find Trustworthy Information.” Presented at the Oklahoma Inter-Tribal Meeting on Climate Variability and Change, Norman, OK, December 12, 2011 (Riley).

“How Weather Affects Public Opinion of Global Warming.” Presented at the annual meeting of the Association of American Geographers, Seattle, WA, April 16, 2011 (Shao).

“Hurricane Impacts.” Keynote speaker. Presented at the National Council for Family Relations Annual Meeting, Orlando, FL, November 17, 2011 (Keim).

“Hurricanes and Climate Change: The Gulf Coast Experience.” Keynote address presented at the Groves Conference on Marriage and Family, New Orleans, LA, March 15, 2011 (Keim).

“Hurricanes in a Changing Climate.” Presented to the Coastal Sustainability Studio, Louisiana State University, January 21, 2011 (Keim).

“Hurricanes of the Gulf of Mexico.” Presented at New Orleans’ Presbytere - Louisiana State Museum speaker series entitled “Living with Hurricanes: Katrina and Beyond”, New Orleans, LA, February 17, 2011 (Keim).

“Hurricanes of the Gulf of Mexico.” Presented to the LSU Retired Faculty Club, September 12, 2011 (Keim).

“Hurricane-related Communication and Decision-Making for the Expert Community and Citizens.” Presentation for the Coastal Community Resilience Team Meeting of the Gulf of Mexico Alliance, Spanish Fort, AL, January 2011 (Edwards).

“Louisiana Drought.” Presented in a Webinar on *Managing Drought in the Southern Plains*, hosted by SCIPP and NIDIS, December 11, 2011 (Keim).

“Louisiana’s Drought Condition.” Presented to the Livingston Parish Cattlemen’s Association, Albany, LA, October 29, 2011 (Keim).

“Managing Climate Change in the Southern United States.” Presented at the Regional Climate Change Planning Meeting, June 28, 2011, College Station, TX (Shafer).

“Managing Drought: A Southern Plains Webinar Series.” Presented for the National Integrated Drought Information System Early Preparedness Communities webinar, December 13, 2011 (Shafer).

“Managing Drought in Oklahoma.” Presented to the Oklahoma Water Resources Board, Oklahoma City, OK, July 1, 2011 (Shafer).

“Monitoring Drought.” Presented at the South Central U.S. State Drought Planning Workshop, Memphis, TN, May 9, 2011 (Shafer).

“Observed Changes in the Frequency of Heavy Precipitation Events in the Southern Climate Region and Policy Implications.” Presented at the 91st annual meeting of the American Meteorological Society, Seattle, WA, January 24, 2011 (White).

“Oklahoma Weather and Climate Needs Assessment: Preliminary Findings.” Presented at Adapting to Oklahoma’s Climate: Continuing Conversation, Norman, OK, May 10, 2011 (Riley).

“Planning to Protect: How We Might Think About A Changing Climate and Be More Ready.” Presented at the America’s Wetland Foundation Blue Ribbon Resilient Communities Forum, Lake Charles, LA, March 22, 2011 (Carter).

“Planning to Protect: How We Might Think About A Changing Climate and Be More Ready.” Climate Communities Webinar Series presentation, March 10, 2011 (Carter).

“Planning to Protect: How We Might Think About A Changing Climate and Be More Ready.” Public presentation at league of women voters January meeting, St. Tammany Parish, LA, January 31, 2011 (Carter).

“Planning to Protect: How We Might Think About a Changing Climate and Be More Ready.” Presented as the first webinar in the series Adaptation in a Changing Climate and its Impact on National Security at The Security and Sustainability Forum, June 21, 2011 (Carter).

“Preliminary Results: Gulf Coast Climate Information Needs Assessment.” Presented at the Practical Solutions for a Warming World at the American Meteorological Society Conference on Climate Adaptation, Asheville, NC, July 18-20, 2011 (Carter).

“Recap of July 2011 Austin Forum.” Presented at the Southern Plains Drought Assessment and Outlook Forum, November 29, 2011, Fort Worth, TX (Shafer).

“Regional Understandings of Climate Variability and Change: A Cross-RISA Dialogue.” Session Chair for the Solutions for a Practical World: AMS Conference on Climate Adaptation, American Meteorological Society, Asheville, NC, July 19, 2011 (Shafer).

“SCIPP Update & Lessons Learned.” Presented at the National Integrated Drought Information System Engaging Preparedness Workshop, Chicago, IL, June 9, 2011 (Shafer).

“Southern Climate Impacts Planning Program: You Can Work Somewhere Other Than a TV Station or the NWS!” Presented to meteorology students at Iowa State University, Ames, IA, March 1, 2011 (Riley).

“Storm Surge Research and Tools.” Presented at the Gulf of Mexico Alliance Annual Meeting, Lafayette, Louisiana, July, 2011 (Needham, Keim).

“Storm Surge Return Periods for the U.S. Gulf Coast.” Presented at the annual meeting of the Association of American Geographers, Seattle, WA, April 14, 2011 (Keim).

“SURGEDAT Database.” Presented at the Severe Storm Prediction, Education, and Evacuation from Disasters Annual Conference, Rice University, Houston, Texas, 2011 (Needham, Keim).

“The Urban Influence on Precipitation in the Southeastern United States.” Presented at the annual meeting of the Association of American Geographers, Seattle, WA, April 13, 2011 (Trevino).

“Urban enhancement of precipitation in the southeast United States.” Poster presented at the 36th Annual Climate Diagnostics and Prediction Workshop, Fort Worth, TX, October 2011 (Trevino).

“Using GIS to Assess Vulnerability to Climate Hazards in the Southern United States.” Presented at the 91st annual meeting of the American Meteorological Society, Seattle, WA, January 24, 2011 (Gottlieb).

“Water Resources Assessment and Management Under Changing Climate at Global and Regional Scales.” Invited talk at International Water Resources Association Annual Conference, Nanjing, China.

2012:

“A Historical Storm Surge Database for the East Coast of the U.S.” Poster presented at the Association of American Geographers Conference, New York, NY, February, 2012 (Keim).

“A Spatiotemporal Assessment of Tornado Warnings within Storm Prediction Center Convective Outlooks using Geographic Information Systems.” Presented at the 92nd Annual American Meteorological Meeting, New Orleans, LA, January 24-27, 2012 (Yuan).

“Activities at the Louisiana State Climatologist Office of State Climatology.” Presented at the American Association of State Climatologists Conference, Destin, FL, July 2012 (Keim).

“Adaptation: The National Perspective.” Presented for New York State Climate Smart Communities Program webinar, October 11, 2012 (Carter).

“An Analysis of Historical Storm Surge Activity along the U.S. Gulf Coast.” Presented at the Resilience and Adaptation to Climate Risks Workshop: Stennis Space Center, Stennis, MS, October 16, 2012 (Needham).

“Analysis of Storm Surge Vulnerability along the U.S. Gulf Coast.” Seminar presented to the Engineering Program at Texas A&M University Galveston, October 2012 (Keim and Needham).

“Building and Analyzing SURGEDAT: The World’s Most Comprehensive Storm Surge Database.” Poster presented at the American Geophysical Union Conference, San Francisco, CA, December 2012 (Keim and Needham).

“Climate Services Partnership Panel.” Presented at the American Association of State Climatologists Annual Meeting, July 10, 2012, Destin, FL (Shafer).

“Communication climate information: Best Practices.” Presented at the Workshop on Communicating Seasonal Climate Information, Norman, OK, September 27, 2012 (Edwards).

“Communicating with climate change visuals: Two exploratory exercises.” Presented at the 7th Symposium on Policy and Socio-Economic Research at the 92nd Annual American Meteorological Meeting, New Orleans, LA, January 24-27, 2012 (Riley).

“Gulf Coast Climate Information Needs Assessment.” Presented on virtual conference #3 hosted by NOAA, Coastal Sustainability Center, and the Coastal Zone Management Authority, October 11, 2012 (Carter).

“Gulf Coast Community of Practice.” Presenting on The US National Assessment Process, April 16, 2012 (Carter).

“How Rare was the 1-3 May 2010 rainstorm in Nashville, TN and the surrounding region?” Poster presented at the Southeastern Coastal and Atmospheric Symposium, Mobile, AL, March 24, 2012 (Billiot).

“Hurricanes.” Presented for a SCIPP webinar on Extreme Events and Hazards, July 26, 2012 (Keim and Needham).

“Hurricanes in a Changing Climate.” Presented to the Baton Rouge Ham Radio Operators, July 30, 2012 (Keim).

“Hurricanes in Mexico.” Presented in webinar on Extremes in the Southwest U.S. and Mexico hosted by CLIMAS (RISA Team), September 6, 2012 (Keim and Needham).

“Impacts of Hurricane Katrina Along the Northern Gulf Coast.” Poster presented at the Association of American Geographers Conference, New York, NY, February 2012 (Keim).

“Managing the 2011 Drought: A Climate Services Partnership.” Poster presented at the American Association of State Climatologists Annual Meeting, July 9, 2012, Destin, FL (Shafer).

“Musings Around Hazard Planning and Climate Adaptation: Parts of a continuum?” Presented at Hazard Mitigation and Climate Adaptation panel of the Annual Meeting of the American Meteorological Society, New Orleans, LA, January 24-27, 2012 (Carter).

“Overview - Resilient Coastal Communities and Economies: Challenges and Opportunities.” Presented at the 6th Educational Partnership Program: Education and Science Forum, Developing STEM Talent: Increasing Innovation and National Competitiveness, Tallahassee, FL, March 26-28, 2012 (Carter).

“Preliminary Results: Gulf Coast Climate Information Needs Assessment.” Presented at the Louisiana Coastal Zone Programs’ Quarterly Meeting, Baton Rouge, LA, January 5, 2012 (Carter).

“Preliminary Results Gulf Coast Climate Information Needs Assessment.” Presented at the Louisiana Sea Grant Quarterly Meeting, Baton Rouge, LA, March 9, 2012 (Carter).

“Regional Climate Services in Response to the Southern Plains Drought.” Presented at the Spring 2012 Great Plains Drought Outlook and Assessment Forum, April 26, 2012, Lubbock, TX (Shafer).

“So you want to work in Climate or Sustainability or Hazards or ... What are you bringing to the table?” Presented at the Hot Topics and Local Weather Session at the 11th American Meteorological Survey Student Conference, New Orleans, LA, January 23, 2012 (Carter).

“Storm Surge Return Periods on the U.S. Gulf Coast.” Presented at the Association of American Geographers Conference, New York, NY, February, 2012 (Needham, Keim).

“Storm Surge Return Periods for the United States Gulf Coast.” Presented at the World Environmental and Water Resources Congress in Albuquerque, NM, May 2012 (Needham, Keim, Sathiaraj, Shafer).

“Storm Surge Return Periods for the U.S. Gulf Coast.” Presented at the ATC-SEI Advances in Hurricane Engineering Conference in Miami, FL, October 2012 (Needham, Keim, Sathiaraj, Shafer).

“SURGEDAT: The World’s Most Comprehensive Storm Surge Database.” Poster Presented at the American Geophysical Union Conference in San Francisco, CA, December 2012 (Needham, Keim).

“Temporal and Geographic Perspectives on Atlantic Hurricanes.” Presented to the LSU School for the Coast and the Environment, August 24, 2012 (Keim).

“The National Climate Assessment - Regions.” Presented at the 2012 Climate Leadership Conference, Association of Climate Change Officers, Weston, FL, February 29, 2012 (Carter).

“The Urban Influence on Heavy Precipitation Events in the Southeastern United States.” Poster presented at the 26th Conference on Hydrology at the Annual Meeting of the American Meteorological Society, New Orleans, LA, January 24-27, 2012 (Trevino).

“Thinking Adaptation? Some of the things you might want to think about.” Presented at Resilience and Adaptation to Climate Risks Workshop: Stennis Space Center Area hosted by CCRUN, October 16-18, 2012 (Carter).

“Using GIS to assess vulnerability to meteorological and climatological hazards in the contiguous United States.” Presented at the 92nd Annual Meeting of the American Meteorological Society, New Orleans, LA, January 24-27, 2012 (Gottlieb).

“Using GIS to assess vulnerability to meteorological and climatological hazards in the contiguous United States.” Presented at the Annual Meeting of the Association of American Geographers, New York, NY, February 24-28, 2012 (Gottlieb).

“Using semi-structured interviews to assess the climate-related needs of Oklahoma decision makers.” Presented at the 7th Symposium on Policy and Socio-Economic Research at the 92nd Annual American Meteorological Meeting, New Orleans, LA, January 24-27, 2012 (Riley).

2013:

“A Louisiana Hurricane and Storm History.” Presented at the National Hurricane Conference, New Orleans, LA, March 2013 (Keim and Needham).

“A Comparison Between North American Regional Climate Change Assessment Program Output and Oklahoma Mesonet Observations: Precipitation.” Poster presented at the 12th Annual Student Conference, American Meteorological Society Annual Meeting, January 6-10, 2013, Austin, TX (Fagan, Lunday, McPherson).

“A Tale of Two Schools: A Case Study of Two Oklahoma School Districts during Tornado Events.” Poster presented for the Eighth Symposium on Policy and Socio-Economic Research, American Meteorological Society Annual Meeting, January 6-10, 2013 Austin, TX (Silvis, Shafer).

“Adaptation Chapter.” Presented for National Climate Assessment Southeast Chapter Town Hall meeting, Tampa, FL, February 19, 2013 (Carter).

“Climate Change and Hurricanes.” Presented to the Ag Leadership Conference, Baton Rouge, LA, December 13, 2013 (Keim).

“Climate Change - how to be more ready.” Invited public presentation to the City of Biloxi, February 28, 2013 (Carter).

“Comparing Louisiana Hurricanes Isaac and Katrina to storms of the Past – A Panel Discussion.” Presented at the National Hurricane Conference in New Orleans, LA, March 2013 (Keim, Needham).

“Coordination with Federal, Tribal, State, and Local Governments.” Panel moderator at the National Drought Forum: The 2012 Drought and U.S. Preparedness for 2013 and Beyond, December 12-13, 2013, Washington, D.C. (Shafer).

“Extreme Events in a changing climate.” Presented at the Western Gulf Silvicultural Technology Exchange, December 12, 2013, Shreveport, LA (Keim).

“Interpretations and implications: Processing a news story about drought.” Paper presented at the annual meeting of the National Communication Association, November 2013, Washington, D.C. (Edwards).

“Managing Drought in the Southern Plains: Discussing Impacts to Promote Planning.” Presented at the 20th Conference on Applied Climatology, American Meteorological Society Annual Meeting, January 6-10, 2013, Austin, TX (Boone, Riley, Shafer). <https://ams.confex.com/ams/93Annual/webprogram/Paper220642.html>

“Managing the 2011 Drought: A Climate Services Partnership.” Poster presented for the Eighth Symposium on Policy and Socio-Economic Research, American Meteorological Society Annual Meeting, January 6-10, 2013, Austin, TX (Shafer).

“Planning to Protect: How to be More Ready in a Changing Climate.” Presented as part of the Climate Science and Adaptation Presentation at the Louisiana Sea Grant workshop, La Fourche Parish, LA, January 10, 2013 (Carter).

“Problems, Policies & Politics: How Science Policy is Made.” Presented to Introduction to Meteorology Science and Policy call, January 23, 2013, National Weather Center, Norman, OK (Shafer).

“Southeast and Caribbean (NCA).” Presented National Climate Assessment briefings for the Union of Concerned Scientists, February 11, 2013 (Carter).

“Southeast and Caribbean and Adaptation National Climate Assessment.” Presented on webinar for Security and Sustainability with Second Nature, March 14, 2013 (Carter).

“Southern Plains NIDIS.” Presented at the RISA Program Annual Meeting, January 15-17, 2013, La Jolla, CA (Shafer).

“Surveying flood information users: an academic-federal partnership.” Presented at the Eighth Symposium on Policy and Socio-Economic Research, American Meteorological Society Annual Meeting, January 6-10, 2013, Austin, TX (Riley, Edwards). <https://ams.confex.com/ams/93Annual/webprogram/Paper218408.html>

“Web-based Climate Tools.” Presented at the Western Gulf Silvicultural Technology Exchange, December 12, 2013, Shreveport, LA (Needham).

“Winter Storm Management Preferences in Oklahoma: A Pilot Study.” Presented at the Eight Symposium on Policy and Socio-Economic Research, American Meteorological Society Annual Meeting, January 6-10, 2013, Austin, TX (Lunday, Riley). <https://ams.confex.com/ams/93Annual/webprogram/Paper223888.html>

9. Publications and Reports

The following are various SCIPP-related publications and reports produced during the past five years. The year of publication is in **bold**. An * indicates that the information was communicated to stakeholders.

Peer Reviewed

- Allard, J., B. D. Keim, J. E. Chassereau, D. Sathiaraj, **2009**. Spuriously Induced Precipitation Trends in the Southeast United States. *Theoretical and Applied Climatology* DOI 10.1007/s00704-008-0021-9.
- Bierbaum, R., J.B. Smith, A. Lee, M. Blair, L. Carter, F. S. Chapin III, P. Fleming, S. Ruffo, M. Stults, S. McNeeley, E. Wasley, L. Verduzco, **2012**: A comprehensive review of climate adaptation in the United States: more than before, but less than needed. *Mitig Adapt Strateg Glob Change*. DOI 10.1007/s11027-012-9423-1.
- Bothwell, J., M. Yuan, **2011**: A Kinematics-based GIS Methodology to Represent and Analyze Spatiotemporal Patterns of Precipitation Change. *Proceedings of the 19th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems* (ACM SIGSPATIAL GIS 2011).
- Bothwell, J., and M. Yuan, **2012**: Apply Concepts of Fluid Kinematics to Represent Continuous Space-Time Fields in Temporal GIS. *Transactions in GIS*.

- Carter, L., and K. Dow, **2012**: Southeast Regional Technical Input Adaptation Chapter.
- Hamilton, L. C., and B. D. Keim, **2009**. Regional Variation in Perceptions about Climate Change. *International Journal of Climatology* 29(15):2348-2352. DOI 10.1002/joc.1930.
- Hoekstra, S., K. Klocklow, R. Riley, J. Brotzge, H. Brooks, and S. Erickson, **2011**: A preliminary look at the social perspective of warn-on forecast: Preferred tornado warning lead time and the general public's perception of weather risks. *Weather, Climate and Society*, **3**(2), 128-140.
- Kafalenos, R. S., K. J. Leonard, with contributing authors D. M. Beagan, V. R. Burkett, B. D. Keim, A. Meyers, D. T. Hunt, R. C. Hyman, M. K. Maynard, B. Fritsche, R. H. Henk, E. J. Seymour, L. E. Olson, J. R. Potter, M. J. Savonis, **2008**. What Are the Implications of Climate Change and Variability for Gulf Coast Transportation? Chapter 4, In: CCSP. Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research by Savonis, M. J., V.R. Burkett, and J.R. Potter (eds.). Department of Transportation, Washington, DC, USA, 445 pp.
- Keim, B. D., T. W. Doyle, and V. R. Burkett, with seven contributing authors, **2008**. How is the Gulf Coast Climate Changing? Chapter 3, In: CCSP. Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research by Savonis, M. J., V. R. Burkett, and J. R. Potter (eds.). Department of Transportation, Washington, DC, USA, 445 pp.
- Keim, B. D., and R. A. Muller, **2009**. Hurricanes of the Gulf of Mexico. Louisiana State University Press: Baton Rouge, Louisiana, 232 pp.
- Keim, B.D., R. Fontenot, C. Tebaldi, and D. Shankman, **2011**: Hydroclimatology of the U.S. Gulf Coast under Global Climate Change Scenarios. *Physical Geography*, 32(6):561–582.
- Keim, B. D., and R. A. Muller, **2008**. Overview of Atlantic Basin Hurricanes. Chapter 4, In: Oceans and Human Health: Risks and Remedies from the Seas. Academic Press/Elsevier, Burlington, MA, pp. 79-89.
- Lamb, P.J., D.H. Portis, and A. Zangvil, **2012**: Investigation of large-scale atmospheric moisture budget and land surface interactions over U.S. Southern Great Plains including for CLASIC (June 2007). *J. Hydrometeor*, **13**, 1719-1738.
- Liu, L., Y. Hong, J. E. Hocker, M. A. Shafer, L. M. Carter, J. J. Gourley, C. N. Bednarczyk, and P. Adhikari, **2012**: Analyzing Projected Changes and Trends of Temperature and Precipitation in the Southern U. S. from 16 Downscaled Global Climate Models under Different Emissions Scenarios. *Theoretical and Applied Climatology*, doi: 10.1007/s00704-011-0567-9.
- Liu, L., Y. Hong, J. Looper, R. Riley, B. Yong, Z. Zhang, J. Hocker, and M. Shafer, **2011**: Climatological Drought Analyses and Projection using SPI and PDSI: A Case Study for Arkansas Red River Basin. *Journal of Hydrologic Engineering*.
- Liu, L., Y. Hong, C. Bednarczyk, B. Yong, M. Shafer, R. Riley and J. Hocker, **2012**: Hydro-climatological drought analyses and projections using meteorological and hydrological drought indices: A case study in the Blue River Basin, Oklahoma. *Water Resources Management*, **26**(10), 2761-2779, DOI: 10.1007/s11269-012-0044-y.
- McNeeley, E. Wasley, L. Verduzco, **2012**: A comprehensive review of climate adaptation in the United States: more than before, but less than needed. Mitig Adapt Strateg Glob Change. DOI 10.1007/s11027-012-9423-1.
- Needham, H. F., B. D. Keim, D. Sathiaraj, and M. Shafer, **2013**: A Global Database of Tropical Storm Surges. *EOS Transactions, American Geophysical Union*, 94(24): 213-214. DOI: 10.1002/2013EO240001.

- Needham, H. F., and B. D. Keim, 2011: A Storm Surge Database for the U.S. Gulf Coast. *International Journal of Climatology*. doi: 10.1002/joc.2425
- Needham, H.F., and B.D. Keim, 2012: A Storm Surge Database for the U.S. Gulf Coast. *International Journal of Climatology*, **32**, 14, 2108-2123.
- Needham, H. F., and B. D. Keim, 2014: An Empirical Analysis on the Relationship between Tropical Cyclone Size and Storm Surge Heights along the U.S. Gulf Coast. *Earth Interactions*. In press.
- Needham, H., D. Brown, L. Carter, H. Holsinger, R. Meyer, S. Seidel, 2011: Climate Change Adaptation: Impacts and Adaptation Options in the Gulf Coast. Published by The Pew Center on Climate Change, 45 pp.
- Needham, H. F., and B. D. Keim, 2014: Correlating Storm Surge Heights with Tropical Cyclone Winds at and before Landfall. *Earth Interactions*. In press.
- Needham, H. F., L. Carter, D. P. Brown, 2012: Impacts and Adaptation in the Gulf Coast. *Pew Center for Global Climate Change*. In press.
- Needham, H. F., and B. D. Keim, 2011: Storm Surge: Physical Processes and an Impact Scale. Recent Hurricane Research – Climate, Dynamics, and Societal Impacts . E. Lupo (Ed.). Intech Open Access. Publisher: Croatia.
- Needham, H., and B. D. Keim, 2011: Storm Surge: Physical Processes and an Impact Scale. Chapter 20, pp. 385-406, In: *Recent Hurricane Research – Climate, Dynamics, and Societal Impacts*, E. Lupo (Ed.). Intech Open Access Publisher: Croatia.
- Nogueira, R., and B. D. Keim, 2010: Annual Volume and Area Variations in Tropical Cyclone Rainfall Over the Eastern United States. *Journal of Climate*. 23(16): 4363-4374, doi: 10.1175/2010JCLI3443.1
- Nogueira, R., and B.D. Keim, 2011: Contributions of Atlantic Tropical Cyclones to Monthly and Seasonal Rainfall in the Eastern United States 1960–2007. *Theoretical and Applied Climatology*, 103(1-2):213-227, DOI: 10.1007/s00704-010-0292-9.
- O’Hair, H. D. In press. Managing community risks through a community-communication infrastructure approach. In H. Canary & R. McPhee (Eds.), *Communication and organizational knowledge: Contemporary issues for theory and practice*. New York: Routledge.
- Pecchioni, L. L., R. Edwards, and S. Grey, 2011: The effects of religiosity and religious affiliation on trauma and interpretations following Hurricanes Katrina and Rita. *Journal of Communications and Religion*, 34, 37-58.
- Piazza, B. P., M. K. La Peyre, and B. D. Keim, 2010: Relating Large-scale Climate Variability to Local Species Abundance: ENSO forcing and Brown Shrimp (*Farfantepenaeus aztecus*) in Breton Sound, Louisiana, USA. *Climate Research*. 42:195-207, doi: 10.3354/cr00898.
- Savonis, M. J., V. R. Burkett, J. R. Potter, with contributing authors T. W. Doyle, R. Hagelman, S. B. Hartley, R. C. Hyman, R. S. Kafalenos, B. D. Keim, K. J. Leonard, M. Sheppard, C. Tebaldi, and J. E. Tump, 2008. *What Are the Key Conclusions of This Study?* Chapter 6, In: CCSP. Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research by Savonis, M. J., V. R. Burkett, and J. R. Potter (eds.). Department of Transportation, Washington, DC, USA, 445 pp.
- Shankman, D., C. Lafon, and B.D. Keim, 2012: Western Range Boundaries of Floodplain Trees in the Southeastern United States. *Geographical Review*, 102(1): 35-52.
- Shao, W., B. D. Keim, J. C. Garand, and L. C. Hamilton, 2014: Weather, Climate, and the Economy: Explaining Risk Perceptions of Global Warming. *Weather, Climate and Society*, 6(1): 119-134.

- Schroeder, A. J., and J. B. Basara, **2010**: Challenges Associated with Classifying Urban Meteorological Stations: The Oklahoma City Micronet Example. *The Open Atmospheric Science Journal*, 4, 100-112.
- Swan, L., and L. Carter, 2012: Southeast Regional Technical Input Education Chapter.
- Trepanier, J. C., H. F. Needham, J. B. Elsner, and T. H. Jagger, **2012**: A Statistical Model of Return Periods for Combined Wind and Surge Hazards from Hurricanes. *The Professional Geographer*.
- Wang, J., Y. Hong, J. J. Gourley, P. Adhikari, L. Li, and F. Su, 2010: Quantitative assessment of climate change and human impacts on long-term hydrologic response. *International Journal of Climatology*, 30, 2130-2137, doi: 10.1002/joc.2023 (special issue on Hydro-climatology).
- White, E., M. Shafer and J. Hocker, **2013**: Trends in heavy precipitation in the Southern United States. *Weather* (in press).

Non Peer-reviewed

- Bednarczyk, C., Y. Hong, L. Liu, P. Adhikari, J. Gourley, J. Hocker, and M. Shafer, **2011**: Assessing Climate Change Impacts on the Blue River Basin of Oklahoma. Submitted to *Water Resources Management*.
- Carter, L., **2011**: Higher Education's Role in Adapting to a Changing Climate. *A publication of the AMERICAN COLLEGE & UNIVERSITY Presidents' Climate Commitment*. Member of the American College and University Presidents' Adaptation Committee.
- Edwards, R., A. Miller, S. H. Grey, and D. Brown, **2010**: Hurricanes and decision-making: The role of emotion, knowledge, and past experience. Paper accepted for presentation at the annual meeting of the National Communication Association, San Diego, CA.
- Eosco, G. M., M. A. Shafer, and B. D. Keim, **2009**: Lessons learned: Evacuations management of Hurricane Gustav. 89th Annual Meeting of the American Meteorological Society, January 11-15, 2009, Phoenix, AZ. <http://ams.confex.com/ams/pdfpapers/151280.pdf>.
- Gottlieb, R., H. E. Brooks, M. A. Shafer, and M. B. Richman, **2011**: Using GIS to Assess Social Vulnerability to Climate Hazards in the Southern United States. Preprints, 6th Symposium on Policy and Socioeconomic Research, American Meteorological Society, Seattle, WA.
- Hocker, J. E., L. M. Carter, M. A. Shafer, and D. O'Hair, **2010**: Developing a baseline for a RISA program: SCIPP's natural hazards and climate change planning survey. 90th Annual Meeting of the American Meteorological Society, January 17-21, 2010, Atlanta, GA.
- Hocker, J. E., **2011**: A Look Back at Major Disaster Declarations: A GIS Perspective. Preprints, 6th Symposium on Policy and Socioeconomic Research, American Meteorological Society, Seattle, WA.
- Ingram, K.T., K. Dow, L. Carter, **2012**: *Southeast region technical report to the national climate assessment*. US Global Change Research Program. 334 pp. Available online at: http://downloads.usgcrp.gov/NCA/Activities/NCA_SE_Technical_Report_FINAL_7-23-12.pdf
- Keim, B. D., and K. D. Robbins, **2009**: Intraseasonal occurrence dates of North Atlantic tropical storms and hurricanes. 105th Annual Meeting of the Association of American Geographers, March 22-27, 2009, Las Vegas, NV.
- Liu, L., and Y. Hong, **2011**: Analyzing Past and Predicting Future Droughts with Comprehensive Drought Indices for Arkansas-Red River Basin. 2011 Symposium on Data-Driven Approaches to Droughts. Paper 34.
- Miller, A., D. Brown, S. Grey, and R. Edwards, **2010**: Crisis knowledge and preparedness four years after Hurricane Katrina: Comparing Gulf Coast populations according to race. Paper presented at the annual meeting of the Association for Education in Journalism and Mass Communication, Denver, CO (top paper for Minorities and Communication Division).

- Nogueira, R. and B. D. Keim, 2009: Characteristics of tropical cyclone rainfall over the eastern United States, 1960-2007. 105th Annual Meeting of the Association of American Geographers, March 22-27, 2009, Las Vegas, NV.
- Trevino [Nordfelt], A. and D. P. Brown, 2009: A comparative study of urban influences on precipitation throughout the south-central United States. 105th Annual Meeting of the Association of American Geographers, March 22-27, 2009, Las Vegas, NV.
- White, E. D., M. A. Shafer, and J. E. Hocker, 2011: Trends in Heavy Precipitation in the SCIPP Region of the Southern USA. Preprints , 6th Symposium on Policy and Socioeconomic Research, American Meteorological Society, Seattle, WA.

SCIPP Reports

- Crawford, K. C., J. B. Basara, B. G. Illston, and A. J. Schroeder, 2009: An analysis of the July and August 2008 heat wave using Oklahoma City Micronet observations. 89th Annual Meeting of the American Meteorological Society, January 11-15, 2009, Phoenix, AZ. <http://ams.confex.com/ams/pdfpapers/150127.pdf>.
- Erickson, S. A., H. E. Brooks, J. G. LaDue, and H. D. O'Hair, 2008: Emergency managers: Weather communication and training. 24th Conference on Severe Local Storms, Savannah, GA, American Meteorological Society.
- Heath, R. L., and H. D. O'Hair (Eds.), 2009: *Handbook of risk and crisis communication*. New York: Routledge.
- * Hocker, J. E., 2011: Geographic Assessment of Major Disaster Declarations Across the Lower 48 States. Available at: http://www.southernclimate.org/publications/Disaster_Report_Final_low-res.pdf.
- * Hocker, J. E., and L. M. Carter, 2010: Southern U.S. Regional Hazards and Climate Change Planning Assessment. A summary report based on a regional survey conducted by the Southern Climate Impacts Planning Program SCIPP). Available at: http://www.southernclimate.org/publications/SCIPP_Hazards_Survey_Report_Final.pdf.
- Keim, B. and Louisiana Office of State Climatology. 2009. Weather Review: Louisiana 2008 and Average Temperature and Precipitation Summary, Louisiana 2008. National Agricultural Statistics Service - 2008 Annual Louisiana Statistical Bulletin, pp. 10-11.
- * L. M. Carter, and J. E. Hocker, 2010: Blending Perspectives to Collectively Address Climate Change Issues Across the Western Gulf Coast and Southern Plains. Summary report of World Café sessions from the August 10-12, 2009 U.S. Fish and Wildlife Service (Regions 2 and 4) and USGS co-sponsored regional climate change workshop entitled "Climate Change: The Western Gulf Coast and Southern Plains." Available at: http://www.southernclimate.org/documents/World_Cafe_2009_Report_Final.pdf.
- Myint, S., M. Yuan, R. S. Cervený, and C. P. Giri, 2008: Categorizing natural disaster damage assessment using satellite-based geospatial techniques. *Natural Hazards and Earth System Sciences*, **8**, 707-719. <http://www.nat-hazards-earth-syst-sci.net/8/707/2008/nhess-8-707-2008.pdf>
- * Needham, H., L. Carter, and B. Keim, 2012: Gulf Coast Climate Information Needs Assessment Survey Results. Available shortly at <http://www.southernclimate.org/>. Communicated to the participants.
- * Riley, R., K. Monroe, J. Hocker, M. Boone, and M. Shafer, 2012: An Assessment of the Climate-Related Needs of Oklahoma Decision Makers. 47 pp. Available at: http://www.southernclimate.org/publications/OK_Climate_Needs_Assessment_Report_Final.pdf. Communicated to the participants and the Governor of Oklahoma.

- * Riley, R. B., **2010**: Oklahoma Climate Adaptation Planning Kick-Off Meeting Summary Report. A summary report on the December 10, 2009 Oklahoma Climate Adaptation Planning Meeting. Available at: http://www.southernclimate.org/documents/Climate_Adaptation_Meeting_Summary_Report.pdf.
- * Riley, R., P. Blanchard, R. Peppler, B. Bennett, and D. Wildcat, **2012**: Oklahoma Inter-Tribal Meeting on Climate Variability and Change. 22 pp. Available at http://www.southernclimate.org/publications/Oklahoma_Intertribal_Climate_Change_Meeting.pdf. Communicated to all 39 Oklahoma tribal leaders and meeting participants.
- * Riley, R., **2012**: *Workshop on communicating seasonal climate information: summary report*. Norman, OK: Southern Climate Impacts Planning Program, 47 pp. Available online at: http://www.southernclimate.org/publications/SeasonalClimate_SummaryReport.pdf.
- Riley, R., R. Edwards, L. Carter, M. Shafer, and M. Boone, 2013: South Central U.S. Hazard and Climate Change Planning Assessment. Southern Climate Impacts Planning Program, 55 pp. [Available online at http://www.southernclimate.org/publications/Hazard_Planning_Assessment.pdf].
- Shafer, M. A., **2008**: Climate literacy and a National Climate Service. *Physical Geography*, **29.6**, 561-574. <http://bellwether.metapress.com/content/u495830084152305/fulltext.pdf>
- Shafer, M. A., T. E. James, and N. Giuliano, **2009**: Enhancing climate literacy. 89th Annual Meeting of the American Meteorological Society, January 11-15, 2009, Phoenix, AZ. <http://ams.confex.com/ams/pdfpapers/150334.pdf>.
- * Shafer, M. and R. Riley, **2012**: Managing Drought in the Southern Plains: A summary of survey responses to the webinar series. Southern Climate Impacts Planning Program, 10 pp. Available online at http://www.southernclimate.org/publications/Webinar_Survey_Summary.pdf
- Shafer, M., **2011-2012**. Managing Drought in the Southern Plains webinar series summaries: Available online at <http://www.drought.gov> in the Southern Plains section

10. Budget

University of Oklahoma

	Year 1 -4	Year 5		
		To 12/31/13		
Total Salaries	\$994,019.74	\$109,589.62		\$1,103,609.36
Total Fringe Benefits	\$263,010.68	\$27,432.89		\$290,443.57
Total Salaries and Fringe Benefits	\$1,257,030.42	\$137,022.51		\$1,394,052.93
Supplies	\$23,292.80	\$276.28		\$23,569.08
Travel	\$131,098.46	\$5,843.17		\$136,941.63
Communications	\$7,596.06	\$683.98		\$8,280.04
Event	\$28,035.33	\$5,518.94		\$33,554.27
Other Costs	\$5,606.00	\$-		\$5,606.00
Subcontracts (IDC)	\$25,000.00	\$-		\$25,000.00
Subcontracts (No IDC)	\$1,172,051.01	\$197,302.08		\$1,369,353.09
Tuition	\$50,041.07	\$5,686.39		\$55,727.46
IDC (26%)	\$382,733.85	\$38,829.69		\$421,563.54
Funding increase posted to IDC	\$0.00	\$0.00		\$0.00
Total Budget	\$3,082,485.00	\$391,163.04		\$3,473,648.04

Louisiana State University

	Year 1 -4	Year 5 To 01/31/14	
Total Salaries	\$ 700,926.74	\$ 171,476.45	\$ 872,403.19
Total Fringe Benefits	\$ 159,044.82	\$ 52,992.31	\$ 212,037.13
Total Salaries and Fringe Benefits	\$ 859,971.56	\$ 224,468.76	\$1,084,440.32
Supplies	\$ 7,820.17	\$ 2,791.87	\$ 10,612.04
Travel	\$ 59,506.09	\$ 15,204.20	\$ 74,710.29
Communications	\$ 4,177.28	\$ 308.13	\$ 4,485.41
Event	\$ -	\$ -	\$ -
Other Costs	\$ 4,215.37	\$ 1,000.00	\$ 5,215.37
Subcontracts (IDC)	\$ -	\$ -	\$ -
Subcontracts (No IDC)	\$ -	\$ -	\$ -
Tuition	\$ -	\$ -	\$ -
IDC (26%)	\$ 443,634.54	\$ 117,011.04	\$ 560,645.58
Funding increase posted to IDC	\$ -	\$ -	\$ -
Total Budget	\$ 1,379,325.01	\$ 360,784.00	\$1,740,109.01
	\$ 1,379,325.01	\$ 360,784.00	\$1,740,109.01